ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXII, No. 9. CHICAGO, SATURDAY, MARCH 1, 1913. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY

608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Secretary.
J. B. McCarthy, Asst. Gen. Mgr. C. W. Forbrich, Asst. Treas.

E. E. Wood . . . . . 13 Park Row, New York, N. Y.
Manager Eastern States.
J. B. McCarthy . . . . . Buhl Block, Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich.....Associate Editor
J. E. Latta.....Associate Editor

SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada.....4.00
One Year, Foreign Countries.....6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIAL:
The Breakdown of High-Tension Cables..... 429
Factors in Electric-Vehicle Performance..... 430
Electricity in Coal Mining..... 430
The Code and the Life Hazard..... 431
The Lunch-Cart as a Customer..... 431
DEPARTMENTS:
Commercial Practice..... 442
Electrical Construction..... 444
National Association of Electrical Inspectors..... 450
Legal Notes..... 452
New Electrical and Mechanical Appliances..... 461
Latest Approved Fittings..... 468
Current Electrical News..... 469
Record of Electrical Patents..... 475
Electric Vehicle Section..... 477
LEADING ARTICLES:
Electricity in Coal Mines..... 435
An Interesting Design of Alternating-Current Switchboard 444
A 2,300-Volt Motor Installation in a Large Flour Mill.... 447
Franchises.—By Maguire and Mooney..... 452
Nomograms for Electrical Problems.—By M. J. Eichhorn.. 456
National Independent Telephone Association Convention.. 458
Filling in the "Load Valley."—By Charles H. Seaver..... 477
Electric Truck Performances.—By J. A. McMeel..... 484
The Development of the Electric Vehicle.—By Arthur Williams..... 490
BOOK REVIEWS..... 460
MISCELLANEOUS:
Meeting of the Commonwealth Edison Section, N. E. L. A. 432
Permanent Quarters for Electric Club of Chicago Being Considered..... 432
Pacific Coast Convention of American Institute of Electrical Engineers..... 432
Lectures on Radioactivity..... 432
Gift to Massachusetts Institute..... 432
T. P. Glidden..... 433
Joint Meeting in Milwaukee..... 433
National Electric Light and American Electric Railway Policy Committees Confer and Vote to Form Joint Committee..... 434
Central-Station Service in Pattern Shop..... 442
Drying Out Electrical Apparatus..... 446
Special Rules in Force in the City of Newark..... 449
A Motor-Driven Pole Changer.—By J. D. Lewis..... 449
Synchronous Motors for Betterment of Service Standards in Water-Power Transmission..... 454
Invention for Land and Cable Lines Announced at Annual Meeting of Mackay Companies..... 455
Doherty Interests Plan Big Development in Colorado.... 455
Expect a Million Autos Soon..... 488
Electric Vehicle Meeting in New York..... 488

Copyright, 1913, by the Electrical Review Publishing Company.

THE BREAKDOWN OF HIGH-TENSION CABLES.

The capacity of conducting cables, like that of electrical machinery, is limited by the permissible temperature to which the insulating materials entering into their composition may be subjected. Heating beyond a definite temperature results inevitably in deterioration of the insulation and ultimate breakdown. This temperature varies somewhat for different insulating materials, and is difficult to determine for any of them, since for a short time most substances of this character may, without damage, be raised to temperatures which, if steadily maintained, would lead to inevitable trouble.

Loss of heat is more rapid, the higher the temperature of the body above that of its surroundings. But for steady current, the generation of heat in copper also increases with temperature, since the resistance goes up. Since the latter effect is overbalanced by the former, a stable condition of equilibrium is reached at a definite temperature for a definite condition of loading, under ordinary circumstances. This applies to most machinery, and to low-tension cables. With high-tension cables, however, another phenomenon enters to complicate matters. This is the loss of power in the insulating medium itself.

With high-tension alternating current, there are two sources of power loss in the dielectric. These are ordinary conduction and dielectric hysteresis, and both increase as the temperature rises. While of little moment at ordinary temperatures, the former, especially, becomes important near the maximum working temperature. Indeed, enough heat may be generated by this cause alone to balance the dissipating ability of the cable, or even to overbalance it, so that when a sufficient temperature has been reached under load, this source of heat generation may be sufficient to maintain the temperature after the load is removed, or even to augment it. In the latter case the rise of temperature may continue indefinitely, since with rise of temperature the leakage current and therefore the generation of heat increases also. This assumes that voltage is applied continuously to the cable after the load has been discontinued.

It is not hard to picture the result of the above condition. After heavy loading on a hot day a high-tension cable reaches a temperature somewhat higher than usual, and passes the critical point. It then continues to heat, even though the load diminishes, and after an indefinite period, perhaps one or more

days, a breakdown occurs at some relatively weak spot, which may have heated locally above the average.

Such a breakdown, occurring under low load, may appear to be a mystery, and many such have been unaccounted for in the past, though probably due to the above cause. This was brought out in the discussion by Mr. Roper at the Institute convention in New York this week. (The phenomena underlying this trouble were observed by Melsom and Booth, and reported in a paper published last year in the *Journal of the Institution of Electrical Engineers.*) The remedy is obvious. After a period of heavy loading it is advisable to disconnect a cable for several hours, in order to allow it to cool. Where there are several conductors in parallel, this is easily done, as each may be given a period of rest in turn during the light-load hours. Where a single conductor is in service, it will not be so easy to accomplish this result while maintaining continuity of service.

FACTORS IN ELECTRIC-VEHICLE PERFORMANCE.

Mr. H. F. Thomson, of the Massachusetts Institute of Technology, recently presented a paper before the Chicago Section, Electric Vehicle Association of America, in which he called attention to three important factors of which cognizance must be taken in studying electric-vehicle performance, viz.: load-factor, mileage-factor, and moving-factor.

Load-factor, in electric-vehicle performance, is the ratio of the rated capacity of the vehicle to the actual load being carried. It is, of course, apparent that 100-per-cent load-factor is just as much to be desired as in central-station practice. A wagon rated at 1,000-pounds capacity should carry a load of approximately 1,000 pounds if maximum efficiency is to be realized.

Mileage-factor may be considered as the ratio of the rated mileage of the vehicle to the distance actually traveled. In this, also, 100-per-cent load-factor is to be desired, in so far as is consistent. It is true that many variable conditions influence the daily mileage of a vehicle, but in many instances this factor can be improved by a judicious routing of machines. Undoubtedly the low mileage-factor of so many vehicles is due to the fact that it is almost beyond comparison with the horse-drawn conveyance, even when running only a portion of its rated mileage.

Moving-factor is the ratio of the actual running time per day to the time consumed in stoppages. Like mileage-factor, this factor can also be improved by giving the proper consideration to the service to be performed. A high moving-factor is also dependent on a high mileage-factor and vice versa. In fact, all of the factors discussed are more or less correlated, and the results of a final analysis of electric-vehicle performance will be proportional, in a degree, to the consideration given these items.

ELECTRICITY IN COAL MINING.

With an abundance of cheap fuel available, it is not strange that coal-mine operators should have been at a loss to know just what saving would be effected by the application of central-station power. In fact, central stations themselves have only recently, after a careful analysis of existing conditions, found that the coal-mining industry offers a particularly attractive field for the supply of central-station power, even on the basis of reduced cost of operation to the mine manager.

The attitude of the coal-mine operator in regard to central-station power may be summarized as follows: First, he believes that he is producing power at a fairly low cost, due principally to cheap fuel; second, not knowing approximately his costs in detail, he is unable to see his saving, if any, as compared with a definite rate per kilowatt-hour for central-station power; and third, the use of central-station energy often requires the purchasing of new apparatus, and the selling of the present generating equipment.

In regard to the first item, the cost of fuel is, of course, low at the mine, but its value should be figured at the price that could be obtained for it if sold.

In regard to the second item, a certain rate per kilowatt-hour for power from a central station is not always an indication to the average operator as to what his total cost for power and his saving will be.

In regard to the third item, if the proper depreciation on the old apparatus has been charged off each year, the value carried on the books should not be very high, as usually cheap equipment is used that depreciates at a rapid rate, especially under the severe service conditions inherent in mine service. The savings effected in many noteworthy instances have within a year been sufficient to pay for the new equipment necessary.

In a new mine one extremely advantageous factor to consider is the fact that with central-station energy available, the investment for the small mine is greatly reduced. An isolated plant costing from $12,000 to $15,000 will in many cases be required where a $5,000 substation will do the work. In some cases it has been found advantageous for the central station to put in the substation machinery and operate it on a rental basis, or sell power converted to low voltage, or direct current at the bus bars. This is the extreme proposition where the mining companies are not sufficiently capitalized to make the improvements and is comparable with the practice of renting simple fixtures to merchants for their lighting contracts, which has also proved advantageous in many cases.

In any case the distribution of the mine load is such as to prove most desirable, as the principal load comes on at, or slightly before, 7 o'clock in the morning and as a rule falls off to a low value between 3 and 4 o'clock in the afternoon, at which time the lighting load picks up during the winter months. It

is true that in some cases a comparatively small load comes on again at 6 o'clock and carries through the peak lighting period, but is not of such proportion as to seriously influence the station capacity.

When due consideration is given the vast tonnage of coal in the many localities, some appreciation will be had of the possibilities of a power market for its production. In this connection attention is called to the article on "Electricity in Coal Mining," published elsewhere in this issue, in which the activities of several central stations in the matter of coal-mine service are outlined. The installations of these companies, covering all possible conditions, have proved mutually profitable and indicate an increasing development in this direction.

THE CODE AND THE LIFE HAZARD.

Speaking before the convention of the Western Association of Electrical Inspectors at St. Louis, recently, Mr. B. H. Glover, of the Underwriters' Laboratories, said that the task of the Laboratories, so far as the electrical industry is concerned, is to promote the use of such electrical fittings and appliances as may be used without danger to life or property and to discourage the manufacture and sale of fittings and appliances so constructed that to use them would result in danger to either. He insisted that this was the task of the electrical inspector, too, and emphasized the importance of hearty co-operation between inspectors and the laboratories in such work. At the same meeting, Mr. W. J. Canada, the president of the Association, who is himself an engineer for an underwriters' board, read a paper in which there was frequently repeated emphasis of the gain in freedom from life hazard to be realized by the adoption in the electrical fields of the practices which his paper recommended. Such references to the life hazard by representatives of fire-insurance organizations are exceedingly interesting, and they are no less pleasing than interesting. It has sometimes been asserted that the inspectors and engineers for these organizations lacked the proper interest in the life hazard of defective electrical construction. It has not been long, in fact, since such engineers have been heard to protest that it was no duty of theirs to give matters of this kind any great consideration. From a purely business standpoint, it probably is not. It is usually fortunate for their clients, however, when they can give the latter the benefit of their knowledge of such matters. In the past, authority of fire-insurance inspectors to condemn wiring on the grounds that it was dangerous to life has been rather limited. The National Electrical Code, to which rulings are generally referred, has not been based very extensively upon considerations of life hazard—not so fully as might have been desired. Since the Code grew out of rules formulated, for the most part, by boards of fire underwriters, it is rather natural that the fire hazard should have been made more prominent than any other consideration. But it does not appear, naturally that this condition should continue.

Although the Code is still issued by an association whose business is protection of the public against fire waste, it should not be a set of rules in which only fire protection is considered. It has now become in fact what from the first it has been in name; that is, a code which is really national in its application. Aside from its use by underwriters, it is accepted without modification or extension by a majority of the other people interested in the promotion of safe wiring. Both the municipal inspector and the electrical contractor, except in a comparatively few large cities, have generally adopted the practice of accepting its specifications as being all that is needed to insure complete safety. This is of itself enough to warrant every practicable effort to provide rules and suggestions for the prevention of the occurrence of electric shock. It is especially encouraging to note the present apparent disposition on the part of the Code committee to provide such rules, as is evidenced, for example, in the now pending changes in the rules concerning the grounding of circuits. In a wiring code that is national there is little excuse for not giving the life hazard of faulty wiring and fittings the fullest possible consideration.

THE LUNCH-CART AS A CUSTOMER.

As a humble, but none the less progressive purchaser of central-station service, the modern night lunch-cart deserves more consideration than it has sometimes received from the new-business department. Securely moored on a corner lot and inviting the weary pedestrian to partake of its stock of hot viands at all hours of the night, an establishment of this kind is not to be scoffed at as additional connected load of a desirable kind. Curiously enough, some of these places of business which have been fitted up electrically illustrate all four of the great divisions of electric service application: heating, lighting, power and communication. Their close head room makes the electric fan and the incandescent lamp particularly useful; frequently they contain public telephone stations, and not seldom do they make effective use of electric signs. The demand is spread over a long period and the consumption mainly occurs when other drains upon the distribution and generating system are reduced in amount. Many of these places are run by young men easily convinced of the benefits of electric service in providing better conditions along the line of cleanliness, improved air at the counter, and a cheerful interior. There is no question, judging from personal conversations with progressive proprietors of this class, that electric service is a real factor in stimulating and holding trade. They may not mean more than $2 or so a month individually, but in towns where these establishments flourish, the business is worth cultivating because it costs so little to meet its demands. It is an off-peak load as a rule, and as such is to be desired by the progressive lighting company.

Meeting of the Commonwealth Edison Section N. E. L. A.

The regular monthly meeting of the Commonwealth Edison Section, N. E. L. A., was held in the drill hall of the Masonic Temple, Chicago, on the evening of February 18. Over 300 members of the section were present, and listened to an interesting paper presented by Peter Junkersfeld, assistant to second vice-president of the company.

Mr. Junkersfeld told in a broad way the things that go to make up Commonwealth Edison service, showing by means of diagramatic lantern slides, the relation between each department and the public, and the departments and the manufacturer.

An interesting fact brought out to show the enormous possibilities for extension is that there are at present about 500,000 homes in Chicago, yet only a little over 104,000, or about one family in five, are using electricity. By way of comparison, Mr. Junkersfeld stated that the power generated would be sufficient to light a double row of standard five-lamp tungsten posts set twenty feet apart, and stretching from Chicago to Panama. The weight of equipment purchased last year would equal the weight of steel and iron in two Eiffel towers. The 800,000,000 kilowatt-hours generated during the past year would have been sufficient, if all converted into heat, to raise 20 miles of the Chicago River and drainage canal from freezing to the boiling point.

Regarding the average size of lighting bills, the statement was also made that of the company's customers, 12,000 have bills that average $12.00 per year or less. During the summer months 30,000 came below $1.00 per month.

Several musical selections by the Section orchestra, and a three-round fencing match comprised the remainder of the evenings program.

Permanent Quarters for Electric Club of Chicago Being Considered.

The meeting of the Electric Club of Chicago on February 20 was given over to a preliminary discussion of the advisability of establishing permanent quarters. A committee which was appointed by President Keech made a preliminary investigation of the suitability of the old Hamilton Club quarters and suggested that favorable action be taken. A committee was then appointed to further investigate the matter and report at the next meeting of the Club, on February 27, at which time a vote will be taken. The entertainment scheduled for the meeting of February 20 was postponed.

Electrical Show at University of Illinois.

The annual electrical show of the Electrical Engineering Department of the University of Illinois was opened on the main floor of the electrical laboratory on February 12. W. L. Abbott, president of the Board of Trustees and chief operating engineer of the Commonwealth Edison Company, Chicago, conducted the formal opening and closed an enormous switch which started the machinery of the exhibit.

The laboratory was elaborately decorated and illuminated with incandescent lamps for the occasion. There were many exhibits of great interest, including a miniature electric railway, examples of the common types of electric lamps, many dynamos and motors, and a high-tension testing set. A number of manufacturers were represented, including the Wagner Electric Manufacturing Company, the Swartz Electrical Company, the Chicago Fuse Company, the Ideal Electric Company and the Pyrene Manufacturing Company.

An electric kitchen and cafe were in operation, in which all of the food was electrically cooked. Among other exhibits were the electric test railway car, an electric furnace, a Poulsen arc and a photometric laboratory.

Pacific Coast Convention of American Institute of Electrical Engineers.

At the request of the Institute members in Vancouver and vicinity, the Board of Directors has authorized the holding of the annual Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver, B. C., on September 9, 10 and 11, 1913. The Vancouver Section has already arranged for a number of papers, and plans are maturing for interesting trips to some of the large hydroelectric installations in the vicinity of Vancouver. Arrangements are being made for special rates over all railroads, and as this will afford to the engineering fraternity an excellent opportunity for visiting this region so interesting from the point of view of hydroelectric development, a large attendance from the East, as well as from the West, is expected.

Professional Relations.

A meeting of the American Institute of Consulting Engineers will be held at the Engineers Club, 32 West Fortieth Street, New York City, on Tuesday evening, March 11, at 8 p. m. The subject of "Professional Relations," which was under consideration at the last meeting, will come up for further discussion. There will be an informal dinner at 6:30 p. m. at the same place.

Lectures on Radioactivity.

It has been found necessary to change the dates for the series of lectures on "Radioactivity" to be given by Edwin P. Adams, of the Palmer Physical Laboratory of Princeton University, under the auspices of the Electrophysics Committee of the American Institute of Electrical Engineers, as announced in last week's issue. The lectures will be given at 8:15 p. m., on Wednesday evenings, March 19, 26, April 2 and 9, in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York City.

Following is an outline of the topics to be treated in the four lectures:

Lecture I: The discovery of the property of radioactivity; radium and its preparation; ionization of gases; nature of the radiations from radioactive substances,—alpha, beta and gamma rays.

Lecture II: The disintegration theory of radioactivity; the distribution of radioactive substance; radium and the age of the earth.

Lecture III: Dependence of the mass of an electron on its velocity; the electron theory of matter; electrons in optical theory; Zeeman effect; emission and absorption of light.

Lecture IV: Metallic conduction; indication afforded by the study of radioactivity regarding the structure of the atom; optical phenomena in moving bodies; the principle of relativity.

The lectures will be open to the membership of the Institute. The members of the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Electrochemical Society, and the Illuminating Engineering Society have also been invited.

Gift to Massachusetts Institute of Technology.

President Maclaurin, of the Massachusetts Institute of Technology, has announced a gift of $25,000 from the American Telephone & Telegraph Company, through President Theodore N. Vail, in payments of $5,000 annually for five years. The money will be devoted to the care, cataloging and maintenance of the electrical library of the Institute and the purchase of additional books. It is also reported that an added endowment will be made by the same company for the purpose of electrical research work at the Massachusetts Institute of Technology.

The Boston Edison Company has spent between $180,000 and $200,000 to overcome smoke nuisance.

P. T. Glidden.

P. T. Glidden, general manager of the Louisville Lighting Company, recently completed his first year with that company, now operated by the H. M. Byllesby & Company of Chicago, and as years are sometimes used to mark and recount events, it may be said that Mr. Glidden has, during that period, accomplished much for his company and for the lighting situation in Louisville.

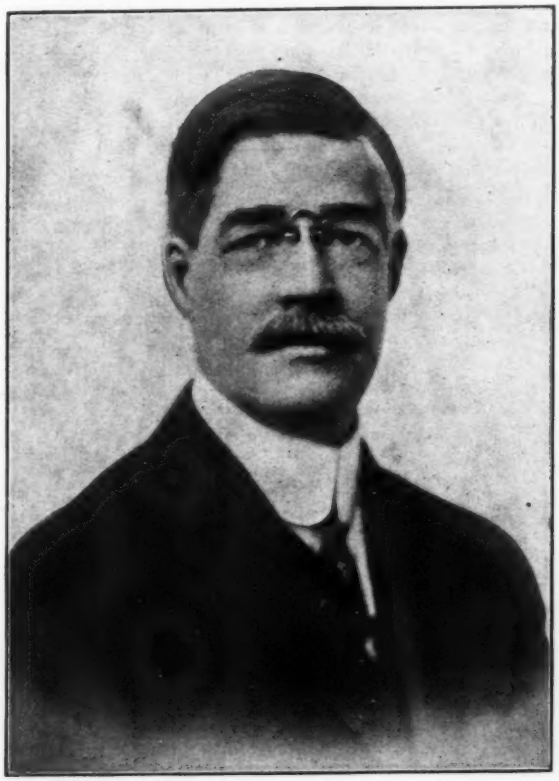
It was Mr. Glidden's fate to come fresh from a stenuous competitive situation in the east to an even more stressful campaign in Louisville. In the year a perfect organization has been effected and a spirit of co-operation engendered that has worked wonders for the company. Not only has the business of the company been largely increased but important extensions have been made to Buchel, Jefferstown, Anchorage, Lyndon and Middletown, all within a twelve-mile radius of Louisville.

From the first Mr. Glidden has devoted considerable attention to the commercial end of the business. Working in conjunction with A. T. Macdonald, general sales manager of the company, he has reorganized the sales department and instigated new and progressive policies in all matters relating to public relations. Notable in this connection has been his insistence on courtesy and patience on the part of all employes coming in contact with the public. One of Mr. Glidden's first official acts in the capacity of manager was to move the display room from an inconspicuous location to the front of the company's offices where the various appliances displayed, could be inspected with the utmost convenience by customers visiting the offices to pay bills, etc. It has been his attention to small details such as these that has made Mr. Glidden's administration such a successful one and been responsible for the high regard in which the company is held by the residents of Louisville.

Mr. Glidden was born in Massachusetts in the year 1870, and reared and educated in South Carolina, and returned to Boston, his native city, in 1887. From early manhood he has been identified with the electrical business, his varied experience making him thoroughly conversant with every phase of the electrical industry.

From 1889 to 1893 Mr. Glidden was with the Holtzer-Cabot Company, and left their employ to go with the Schaeffer Electrical Company. In 1895 the New York Edison Company added Mr. Glidden to its staff and for eight years he was with this company, in the operating department, but the greater part of the time in the business and commercial departments.

The year 1903 he spent with the Ohio Brass Company. In 1904 he was offered and accepted the position of manager of the new-business department of the Binghamton Light, Heat & Power Company. A year and a half of effort there resulted in his being elected vice-president and general manager. A few months later he assumed charge of the Sayre Electric Company and a year after became vice-president and general manager of the Eastern Pennsylvania Power Company of Easton, Pa., retaining the management of the Binghamton and Sayre concerns until becoming associated with the Louisville Lighting Company.



P. T. Glidden.
General Manager, Louisville Lighting Company.

Fire at Scottsburg.

The power house of the Indianapolis & Louisville Traction Company at Scottsburg, Ind., was partially destroyed by fire on February 16, putting the system out of commission for a time.

JOINT MEETING IN MILWAUKEE

Engineers, Architects and Ophthalmologists Co-operate in One-Day Convention on February 22.

On February 22 there was held at the Republican House, Milwaukee, Wis., a joint meeting which was participated in by the Milwaukee Section of the American Chemical Society, the Wisconsin Chapter of the American Institute of Architects, the Milwaukee and Madison Sections of the American Institute of Electrical Engineers, the Engineering Society of Wisconsin, the Chicago Section of the Illuminating Engineering Society, the Milwaukee Electrical League, the Milwaukee Engineering Society, the Milwaukee Oto-Ophthalmic Club and the Milwaukee Company Section of the National Electric Light Association.

The morning session was held at 11 o'clock, and was called to order by F. A. Vaughn, "generator" of the Milwaukee Electrical League. P. H. Connolly, president of the Engineering Society of Wisconsin, presided during the meeting. The following papers were presented: "Concrete Roads and Streets," by H. J. Kuelling, county highway commissioner, read by A. E. Broker; "Brick and Other Paving Materials," by George H. Randall, city engineer of Oshkosh; "City Planning as Taught and Practiced in Europe," by L. S. Smith, professor in the University of Wisconsin.

At 1:30 p. m. a luncheon was served under the auspices of the Milwaukee Electrical League, at which short talks were made by C. Nesbitt Duffy on behalf of the League; by J. R. Cravath on behalf of the Chicago members of the Illuminating Engineering Society; by Armand Koch, on behalf of the American Institute of Architects; by F. E. Turneaure, dean of the University of Wisconsin; by L. S. Smith, also of the University of Wisconsin; and by Euclid Worden on behalf of the Milwaukee Engineering Society. These speeches were interspersed with selections of vocal music.

In the afternoon an inspection trip was made to the plant of the Milwaukee Coke & Gas Company, where the Solvay process was seen in operation.

At 5:30 p. m. another session, devoted to illumination, was held at the Republican House. F. A. Vaughn,

chairman of the Chicago Section of the Illuminating Engineering Society, presided at this session. The first address was by M. Luckiesh, of the National Electric Lamp Association, Cleveland, O., on the subject, "Light and Art." Mr. Luckiesh demonstrated by a long series of experiments the effect upon works of sculpture, upon architectural moldings and upon paintings, of the color, direction and quantity of illumination. He performed a number of experiments in the mixing of colored lights and explained the elements of hue, saturation and quantity, which determine the characteristics of any color.

The next paper was by F. A. Vaughn and Nelson M. Black, M. D., entitled "Discussion of Ocular Comfort and its Relation to Glare from Reflecting Surfaces." Mr. Vaughn read the paper, which emphasized the evils of glare, denounced the use of glazed paper for printing and pointed out that by a proper selection of paper with respect to texture, color and surface, good halftone reproductions could be made with papers free from glare. A large number of samples of paper, prints and magazines were exhibited to illustrate these facts. *The Railway Electrical Engineer, Good Lighting* and the "Electrical Metermen's Hand Book" were cited as examples of the printers' work which were free from the objection of glare. The Illuminating Engineering Society has adopted a similar mat paper for use in publishing its *Transactions*. These examples show what can be accomplished in this line and some of these suitable papers are no more expensive than calendered papers. An uncoated paper is to be preferred for works of permanence, such as the books kept in libraries. Bond paper is fairly good for the purpose and its light weight offsets the high cost per pound in the matter of expense of paper. Choice of ink is necessary also in avoiding glare. In the schools of London, England, different sizes of type have been adopted in the school books for children of different ages. A discussion of specular, diffuse and spread reflection was given and illustrated with lantern slides. The effect of the paper and the source of light on visual acuity and muscular and retinal fatigue were considered, and it was pointed out that the quality of the light affected these conditions. Visual acuity is greater with monochromatic light, and consequently it may be preferable to use colored paper or colored ink.

As part of the discussion on this paper Dr. Black spoke of the physiology of vision and the mechanism of the retinal changes which occur in the operation of seeing. He discussed the elements which affect visual acuity and eye-strain and exhibited lantern slides showing the construction of the eye.

The next paper was entitled "A Photometer Screen for Use in Tests of Street Illumination," by Arthur H. Ford, professor in the State University of Iowa. In the absence of the author this paper was presented by J. R. Cravath.

Since street illumination is needed in all directions it is not satisfactory to make tests on merely a horizontal plane or a plane normal to the direction of light flux. The author, therefore, suggested the use of a curved surface or one made up of a combination of flat surfaces at different angles, which should be translucent and used as a test screen such as is necessary on a Sharp-Millar photometer. The author had tried experiments with a number of screens of different shapes, making use of such a photometer and determining the relative readings for light incident from different angles. Five forms of screen were used: (1) a flat disk, as regularly used in the Sharp-Millar photometer; (2) a cube of paraffin covered with an opaque screen on one side; (3) paraffin in the shape of one-quarter of a sphere; (4) a hemisphere of Alba glass with one half blackened; (5) same as (4) with paper on the flat side. Curves were given showing the results for these different screens, and the author recommended (3) because of the nearness of equality of readings for light from different directions, although (5) was also considered satisfactory.

The last paper was by M. Luckiesh and was entitled "The Influence of Colored Surroundings on the Color of the Useful Light."

Theoretical calculations and colorimeter measurements were made by the author to determine the magnitude of the influence of colored surroundings on the color of the useful light. Much attention has heretofore been given to the color value of illuminants, when after all the color value of the useful light is perhaps of greater interest to the user. It was suspected that especially in indirect lighting the colored walls and ceiling, even though nearly white, would cause appreciable color changes in the incident light. Calculations given in this paper show that only a moderately yellow paper is required to change the color of tungsten light to that of a carbon-filament lamp. Both direct and indirect lighting were considered in the computations; the results obtained are plotted in several ways.

A miniature room was fitted with a tungsten unit in the middle of the ceiling. The walls and ceiling were covered with combinations of green, yellow and white paper. Colorimeter readings were made with direct and indirect lighting. These are shown in a table and in a color-triangle. Reflection coefficients are briefly discussed and measurements presented for several papers illuminated by various illuminants. These measurements were made with a flicker photometer.

At 8:00 p. m. an informal dinner was served.

National Electric Light and American Electric Railway Policy Committees Confer and Vote to Form Joint Committee.

The members of the Public Policy Committee of the National Electric Light Association and the members of the Public Policy Committee of the American Electric Railway Association, at the invitation of Arthur Williams, chairman of the committee of the National Electric Light Association, met at dinner at the Union League Club, New York, on the evening of February 17. The dinner was attended by President George H. Harries of the Electric Railway Association and President F. M. Tait of the National Electric Light Association. The two Public Policy Committees were very fully represented by their members as follows: N. E. L. A.—Chairman Arthur Williams; E. W. Burdett, H. L. Doherty, C. L. Edgar, W. W. Freeman, T. E. Murray, S. Scovil and C. A. Stone. A. E. R. A.—Chairman T. N. McCarter, P. Calhoun, O. T. Crosby, J. H. McGraw and W. H. Heulings. In addition to these highly representative men there were present as representing great public utility systems or groups, Frank Hedley, E. T. Pardee, H. G. Bradlee, E. A. Maher, C. C. Pierce, John W. Lieb and C. Loomis Allen. Judge E. P. Matthews was also present. The societies were also represented by their respective secretaries, T. C. Martin and H. C. Donecker, while the dinner and other arrangements of the conference were in the hands of Walter Neumueller.

It was unanimously voted to form a joint committee of five, each association to select two from the sister body and these four members to elect the fifth. The meeting was addressed by General Geo. H. Harries and F. M. Tait, and by Messrs. McCarter, Williams, Edgar, Doherty, Hedley, Scovil, Maher and Burdett.

The joint committee will work on matters of common technical interest, and it it presumed that the joint consideration of the larger questions which affect the services of the public will be of great assistance in shaping proper measures in the future so that the greatest good may be secured for the public, the employee and the investor.

Electricity in Coal Mines.

A careful analysis of operating conditions in the coal-mining industry has demonstrated that a saving in the cost of producing coal can be effected by the use of central-station power. Substantiating facts and figures are given in this article, which treats of the subject from the central-station point of view.

The magnitude of the coal-mining industry in the United States is indicated by the fact that during the year 1911 the total production of coal was approximately 500,000,000 net tons, of which amount more than 415,000,000 net tons were bituminous. The coal production of the United States represents 38.1 per cent of the coal produced by all the coal producing countries of the world.

In view of these figures it is evident that the power requirements of this industry represent an annual outlay of such proportions as to justify the most careful scrutiny of all factors entering into the cost of producing and applying the energy required for the numerous mechanical aids which have become indispensable to the modern working of coal mines.

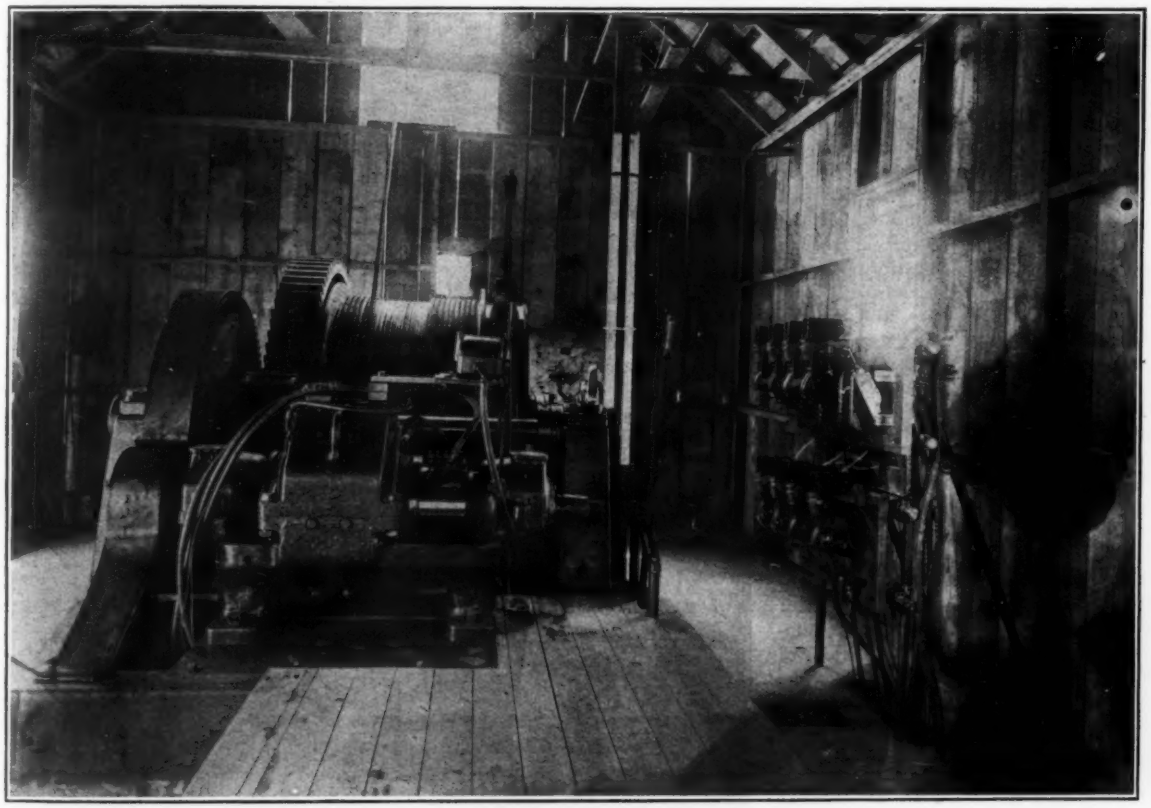
The use of electricity in local mining is not new, as it has been employed to a limited extent for many years. Recently, however, rapid advances have been made in completely electrifying coal mines and it is now generally conceded that electrical apparatus will supersede steam equipment as rapidly as the change can be made.

It was unavoidable in the early days of the industry that the low cost of fuel and general familiarity of operators with the uses of steam power should tend toward a very widespread use of engines of various types for hoisting, pumping, ventilation, surface haulage, and the driving of conveyors, breakers, tipples, etc. The use of steam in the mines has, however, always been both difficult and costly, and in even the most limited application underground it serves to diminish the factor of safety in an industry in which potential danger to workmen must always be a matter of primary importance.

Compressed air for underground work met some of the objections to the use of steam, and as a result was extensively used for this class of work until the advent of electrical service, which at once rendered possible the application of a single form of power to all classes of machinery, both on the surface and in the mine itself.

Advantages of Electricity.

Space permits of brief discussion of only a few of the more important advantages of electric over other forms of drive for coal mines. Perhaps the most important of these is economy. The use of electricity eliminates the necessity for long lines of steam or air piping, which are expensive to install and maintain, and with which the danger of breakdown and the difficulty of obtaining the necessary working pressures increase with every extension of the service. For these conditions electricity substitutes a simple and thoroughly flexible system of transmitting power by means of conductors which can be easily run and rapidly extended to meet changes, involved in the progress of development, which are not affected by temperature variation and are not liable to me-



Electrically Operated Mine Hoist with 90-Horsepower Motor.

chanical injury or to breakage due to floods or shifting ground. They can be safely used in places where steam lines would introduce an element of danger, and finally, they can in many instances be run in shafts or bore holes already in use for other purposes without occupying room that could be otherwise utilized.

Notwithstanding the remarkable efficiencies which have been obtained by the engineers of some mining companies in the operation of carefully constructed steam lines, the investment and operating expense of this method has been so heavy that resort to the alternative of separate boiler plants even in comparatively closely grouped developments has often been found necessary.

In the application of electric motors to the various machines the characteristics of modern types of both alternating and direct-current motors are such that in a majority of cases they can be direct-connected or direct-geared to the driving shaft, thereby eliminating a large percentage of the friction losses and repair charges, as well as the first cost of the belting and countershafts.

It is also possible to further reduce the power losses by substituting individual drive in the sections of long conveyor or scraper lines, and for the different units in breakers and tipples, thereby effecting a considerable saving in power over that required by the older method of group operating by means of engines. In the case of motor-driven breakers, the saving effected in belting alone is a very considerable item, but due to the design of some of the breakers and tipples, the retention of some belts and countershafts is still necessary. For the driving of coal crushers the interposition of belting is not usually considered in modern equipments as the motors are capable of carrying heavy overloads for the short periods during which they are liable to occur in this particular service.

The flexibility of motor drive renders possible the use of portable machinery, and additions to or changes in the location of existing machines can easily be arranged for without interfering in any way with the operation of the remainder of the equipment.

The benefits of electric lighting, both in the mine and for night operations on the surface and for signaling, are universally acknowledged, and electric current is used for these purposes even in mines which have not as yet adopted electric power service.

Motor Applications.

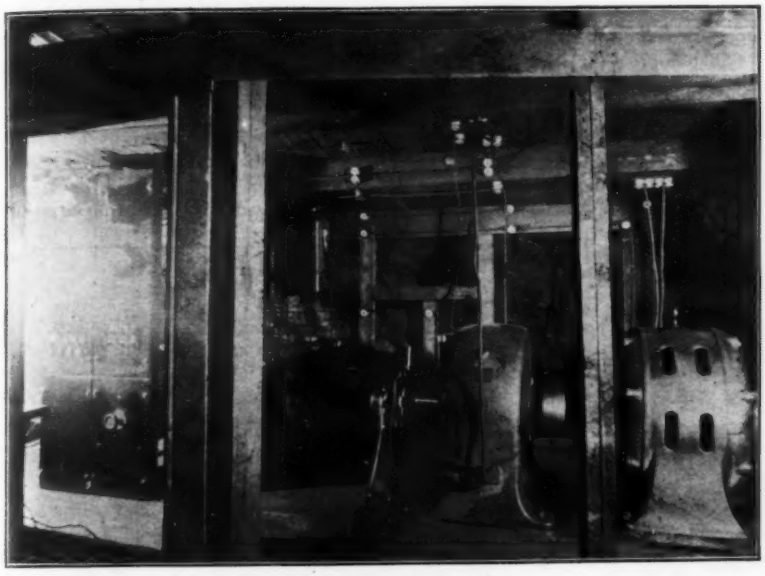
The primary operations involved in the production of coal are undercutting, transporting, and hoisting. The secondary operations, as far as power requirements are concerned, are ventilation, drainage or pumping, operation of tipple and other outside machinery, and a small amount of lighting. Sometimes, however, the question of hoisting is eliminated where drift entries occur, and on the other hand the pumping sometimes becomes one of the primary operations.

Electric Mine Locomotives.

As regards cutting, it is interesting to note that the electric coal cutter is estimated as reducing the cost of production of coal from 10 to 12 cents per ton. This operation is one offering a very good load for power as it is fairly continuous throughout the day hours up to 3 or 4 o'clock in the afternoon, and very often forms a fairly desirable night load from 6 o'clock until midnight. It is probable that a more universal electrification of mines will show considerable increase in the use of power for this purpose, as a great many mines which have animal haulage at the present time are using hand methods for undercutting the coal. Statistics show that in one state alone, from 1905 to 1909, there was over 300

Electric Coal-Cutting Machine.

per cent increase in the number of electric cutting machines in service, as against something like 30 per cent increase in the number of air cutting machines.



Typical Mine Motor-Generator Set.

In connection with cutting operations, there are installations where compressed air is in use and will doubtless be perpetuated owing to local conditions of the cost of the installation. It is very probable that in installations of this kind low central-station rates for the supply of power will show economy in driving these air compressors with electric motors.

As regards the haulage problem, it is too well known that electricity is superior to any other form of haulage for a discussion of its merits at this time. It is recognized that in certain few mines the danger of gas explosions is too great to introduce an electric locomotive using trolley for collecting the current. In this case, probably the safest form of mechanical haulage is the compressed-air locomotive and the compressor drive again forms a possible market for electric power and makes an extremely desirable load.

Electric Gathering Locomotive.

The combined problems of cutting and hauling form the nucleus around which an electric installation can be made, and while it is proposed to discuss the question of installation costs a little later, it should be noted that these two problems are usually considered at one time in determining upon such improvements. A number of factors enter into the question of such improvements and where the older mines are not equipped with mechanical haulage, it is necessary in most cases to relay the track with heavier rails to stand the weight of the locomotive, which must necessarily be heavier than the cars in order to offer sufficient draw-bar pull to permit of bunching cars into trains and cut down the labor attendant upon the old system.

After a mine has assumed commercial proportions with any considerable development away from the entry or shaft, it is seldom difficult to demonstrate the possible savings in the use of electric haulage.

The relative importance of the pumping equipment in different coal mines is dependant upon the geological conditions encountered. In many mines the service required constitutes a comparatively negligible demand on the power station, owing to the possession of natural drainage facilities, with a resulting limitation of the pumping units to those required for fire protection and a few dip pumps operating at low heads.

On the other hand, a large percentage of the mines situated below local water levels are absolutely dependent for continuous operation on the efficacy of their pumps or water hoists, and the cost of their operation has a vital influence on the obtainable margin of profit. The importance of this factor can be fully appreciated when it is realized that in many mines more than ten tons of water have to be elevated to the surface for every ton of coal mined. In addition to this the pumping outfit must ordinarily have sufficient reserve capacity to cope with excessive demands due to floods having their source either on the surface or in water bearing ground which is likely to be encountered in extending the workings.

As in the applications already referred to, the electrical operation of pumps renders possible increased economies and efficiencies otherwise unobtainable, and the benefits derived as compared with either steam or air power service increase in direct proportion to the diversity of the applications and the distances over which the power has to be transmitted.

Two facts have contributed to simplify the problem of the main pumping units in coal mines: First, the recent improvement in the efficiencies of multi-stage centrifugal pumps, which were formerly only applicable to comparatively low-head service, but are now successfully delivering water from sumps located more than 1,000 feet below the surface; the best results being obtained when they are driven by motors that are direct connected, thereby avoiding the friction losses of gear drive. The high speeds which are characteristic alike of the electric motor and the centrifugal pump render it a simple matter to design a very effective combined unit. Second, the feasibility of providing existing pumps or water hoists, originally designed for steam operation, with motor drive, which at once greatly reduces the amount of power required and the expense of attendance necessary, and can be made automatic in operation.

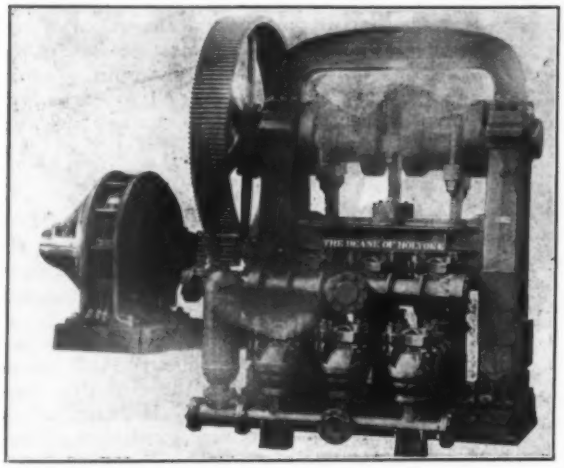
Where motors are geared to reciprocating pumps their use insures the direct application of a larger percentage of the initial power developed than other methods, and many pumping sets of this class are still employed, although the centrifugal type is usually adopted for new installations.

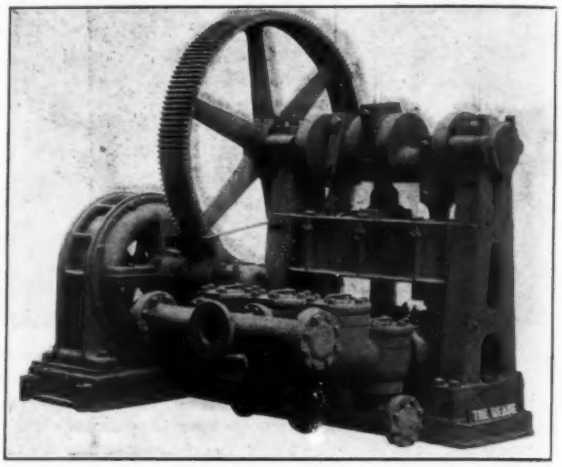
The pumping units of a representative "wet" coal mine can be roughly divided into four classes, i. e., sinking pumps, used in development work, in sumps or for emptying flooded mines; main sump pumps, permanently installed in the mines; auxiliary pumps feeding into a central sump; and portable pumps for temporary service or removing small amounts of water from depressions beyond the reach of the stationary auxiliary pumps, or for fire fighting. There is also a fifth class which, however, is common to all power station service, and includes those units which provide general water supply.

In shaft mines the most serious problem in the application of electricity is that of hoisting. There seems to be more or less prejudice among coal-mining men in this country against the electric hoist, whereas, in Europe the principal mines are usually so equipped. Probably one of the most logical reasons for this is a lack of knowledge of their operation. The electrically operated hoist has numerous and well defined advantages as compared with steam and air systems, which can be outlined as follows:

The power is uniformly applied throughout the operating cycle as there is no reciprocating motion or intervening connecting rods or cranks with their varying torque at different positions, and the power demand is limited to the time during which the hoist is in actual operation; this feature not only minimizes the amount of power consumed, but under special

(Continued on page 441)





Two Examples of Motor Driven Pumps for Mine Service.

Type of Mine	Tons Coal Mined for Month of Test	Connected H. P. Electric	Actual Mo Consumption K. W. H. from Test	STEAM H. P. AND DRIVE Tipple	Fans	Pumps	Misc.	Total H. P.	Equiv K. W. H. Electric	K. W. H. Per Ton Mined	Grand Total H. P. St. & El.	Grand Total K. W. H.	Estimated Load Factor Per Cent	Total K.W.H. PerTon Mined Steam and Elec.
Drift	17,600	443	45,838								443	45,838	19.2	2.6
"	37,050	861	100,327	75	175	67	15	332	76,934	2.07	1193	177,261	27.6	4.78
"	6,300	180	4,264	75	30	10		115	18,772	2.98	295	23,036	14.8	3.65
"	14,245	186.5	8,500	152	50	35	32	237	39,850	2.79	424	48,350	21.2	3.39
"	12,987	100	6,880	10	50			92	15,704	1.20	192	22,084	21.4	1.70
"	6,550	409	13,000	10	3	7.5		20.5	2,000	.30	429	15,000	17	4.37
"	10,300	247	17,862								247	17,862	13.6	1.73
"	10,050	339	15,280			10		10	3,120	.31	349	18,400	9.8	1.83
"	18,000			100	50	15	5	170	26,200	1.45	170	26,200	28.7	1.45
"	18,600	490	69,000								490	69,000	26.2	3.71
"	15,000	380 MG Sets	41,000								380	41,000	20	2.73
"	13,550	525	9,828	20	60	5	1	86	20,140	1.48	611	29,968	9.1	2.21
"	9,400	252	16,000	60		15	15	90	8,024	.85	342	24,024	13.1	2.56
"	28,550	755	103,900								755	103,900	25.6	3.63
Shaft	17,850	240	32,000		50	480	225	755	114,000	6.4	995	146,000	35	8.2
Drift	19,022	490	18,880		150			150	61,500	3.23	640	80,380	23.3	4.22
Shaft														
Drift	19,050	190	43,758		40			40	12,480	.65	230	56,238	44.5	2.95
"	20,850	328	21,000		90	15	15	120	38,000	1.82	448	59,000	24.5	2.82
"	25,500	948	78,280			20		20	5,400	.211	968	83,680	16	3.28
"	10,950	268	30,000								268	30,000	20.8	2.72
	37,750	475 MG Sets	43,250								475	43,220	17	1.15
	26,100		23,700											
	16,650		19,550											
"	19,350	454	100,000	80		12		92	8,000	.41	546	108,000	38.2	5.58
"	21,142	233	12,400	75	50	20	30	175	31,100	1.47	408	43,500	19.8	2.05
"	11,210	291	23,850	10	20	20		50	6,106	.54	341	29,956	16.4	2.67

Coal Mining Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use of 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Coal mine near Bluefield, W. Va., having an average production of 10,700 tons per month.

Total connected horsepower, 455. Total number of motors installed, 5. Average kilowatt-hours per month, 37,655.

Kilowatt-hour consumption for 9 months:

Month	Kilowatt-hours.	Tons Coal	Month	Kilowatt-Hours	Tons Coal	Month	Kilowatt-Hours	Tons Coal
April	26,900	11,571	July	37,800	11,585	October	57,700	12,102
May	29,000	9,262	August	43,800	12,258	November	43,200	9,407
June	29,500	8,742	September	41,400	11,050	December	29,600	10,752

Load-factor, 15 per cent.

The average energy consumption per ton of coal mined is 3.4 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	300	900	Direct-connected to one 200-kilowatt 250-volt direct-current generator for supplying energy to the following: one 12-ton haulage locomotive; one 10-ton haulage locomotive; two four-ton gathering locomotives three 30-horsepower cutting machines; and one 15-ton Larry motor.
1	100	720	Slip-ring motor belted to shafting driving one automatic feeder; three sets of shaker screens; two jigs; one pump; two drag lines, 100 and 50 feet respectively; four elevators, 330 feet; one crusher; and one 60-foot picking table.
2	20	720	Each belted direct to a 16-foot Crawford & McCrimon fan.
1	15	900	Geared direct to deep-well pump.

Energy is supplied by the Appalachian Power Company.

Coal mine located near Bluefield, W. Va., having an average monthly production of 22,000 tons. This mine uses no cutting machine inasmuch as the coal formation is such that it is not necessary. There is still some steam haulage equipment that has not as yet been changed over.

Total connected horsepower, 325. Total number of motors installed, 3. Average kilowatt-hours per month, 17,300.

Kilowatt-hour consumption for 9 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
June	16,000	September	18,500	December	16,100
July	16,500	October	20,500	January	16,000
August	17,000	November	17,300	February	17,300

Load-factor, 9.7 per cent.

The average electrical energy consumption per ton of coal mined is 0.78 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	225	900	Direct-connected to a 150-kilowatt 250-volt direct-current generator supplying energy to the following: one 12-ton haulage locomotive; one 10-ton haulage locomotive; one five-ton gathering loocmotive; and one 15-horsepower motor, 900 revolutions per minute direct-connected to pump.
1	40	840	Belted direct to a 16-inch Cappell fan, speed 98 revolutions per minute.
1	40	570	Slip-ring motor, operating tipple.

Energy is supplied by the Appalachian Power Company.

Coal mine located near Bluefield, W. Va., having an average monthly production of 20,000 tons. Some steam equipment is still temporarily retained.

Total connected horsepower, 225. One motor. Average kilowatt-hours per month, 10,926.

Kilowatt-hour consumption for five months: August, 10,550; September, 7,560; October, 10,390; November, 11,300; December, 14,833.

Load-factor, 8.9 per cent.

The average electrical energy consumption per ton of coal mined is 0.54 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 440 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	225	900	Direct-connected to one 150-kilowatt 250-volt direct-current generator supplying energy for the following direct-current equipment: one 10-ton haulage locomotive; one six-ton gathering locomotive; one 15-horsepower motor direct-connected to 12-foot fan; one 15-horsepower motor belted direct to 14-foot fan; one short-wall mining machine; and one five-horsepower motor geared to pump.

Energ yis supplied by the Appalachian Power Company.

Coal Mining Data—Sheet No. 2.

Coal mine located in Western Pennsylvania, having an average monthly output of 20,000 tons.
Total connected horsepower, 1,246. Number of motors, 21. Average kilowatt-hours per month, 517,556.
Kilowatt-hour consumption for six months:

Month.	Kilowatt-hours.	Tons Coal.	Month.	Kilowatt-hours.	Tons Coal.
February	596,890	20,330	May	452,970	13,178
March	771,580	27,631	June	415,980	19,833
April	393,410	9,626	July	474,510	21,662

Load-factor, 76 per cent.
The approximate total electric energy consumption per ton of coal mined is 3 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 600 volts direct current, and two-phase, 60-cycle, 220 volt, alternating current.

No.	Horse-power	Type	Application.
2	125	Series	Drives six-foot hoist drum through three sets of gears.
2	88	Compound	Belted to five-foot hoist drum.
1	200	690 R. P. M.	Alternating-current motor belted to exhaust fan, operating continuously.
1	175	Shunt	Geared to Worthington 10-inch turbine pump.
1	106	Shunt	Driving Aldrich 14 by 12-inch triplex pump.
1	60	Shunt	Belted to a six-wheel single-stage centrifugal pump.
1	60	Shunt	Belted to an 8 by 12-inch duplex pump.
1	4	Shunt	Belted to a Blackmer two-inch rotary pump.
1	5	Shunt	Belted a three-inch triplex pump.
1	10	Shunt	Belted to a Boyts & Porter four-inch duplex pump.
1	10	Shunt	Belted to a 10-foot line shaft driving one 16-inch drill press; and one 24-inch centrifugal fan for forge blower.
8	25	Shunt	Driving Jeffrey six-foot under-cut mining machines.

One 10-ton and one 8-ton locomotive, employed, are not included in the above.

Coal mine, having an average monthly output of approximately 2,000 tons. There are 22 miners working in two shifts of 9 hours each.
Total connected horsepower, 71. Number of motors, 4. Average kilowatt-hours per month, 1,653.
Kilowatt-hour consumption for 12 months: August, 1,025; September, 2,257; October, 1,737; November, 1,302; December, 1,046; January, 1,361; February, 2,043; March 1,979; April, 1,907; May 1,994; June, 1,567; July, 1,625.
Load-factor, 4.3 per cent.
The average electric energy consumption per ton of coal mined is 1.3 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 600 volts, direct current and two-phase, 60 cycles, 220 volts, alternating current.

No.	Horse-power	Type	Application.
2	25	Shunt	Driving Jeffery six-foot under-cut mining machines.
1	11	Series	Geared to 24-inch drum hoist hauling two two-ton cars up 200-foot incline, 20 per cent grade.
1	10		Alternating-current motor belted direct to 96-inch Stine ventilating fan.

Coal mine, having an average monthly output of 14,000 tons. There are 140 men employed working 8 hours per day. Hauling is done by mules, two 10-ton and two 6-ton electric locomotives.
Total connected horsepower, 245. Number of motors, 16. Average kilowatt-hours per month, 17,787.
Kilowatt-hour consumption for 9 months: November, 19,900; December, 19,880; January, 19,030; February, 10,202; March, 21,770; April, 10,370; May, 17,751; June, 18,962; July, 22,218.
Load-factor 13 per cent; operating-time load-factor, 42 per cent.
The approximate electric energy consumption per ton of coal mined is 1.22 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 500 volts direct current.

No.	Horse-power	Speed R. P. M.	Winding	Application.
1	10	1,040	Shunt	Belted direct to a Stine suction fan, 5-foot diameter by one-foot face, running continuously at 300 revolutions.
2	20	1,040	Shunt	Each belted direct to a Stine suction fan, 6 foot diameter by one foot face, running continuously at 300 revolutions per minute.
1	20	1,040	Shunt	Direct-Connected to a Morris No. 3, four-inch centrifugal suction pump. Operates about two hours daily.
1	2.5	1,200	Shunt	Geared through two reduction gears to a 3 by 4-inch by 40-stroke Dean triplex pump.
3	10	1,200	Shunt	Each geared through two reduction gears to a 4 by 6-inch by 40-stroke Deming triplex pump.
4	25		Shunt	Each driving a Morgan-Gardner 6-foot undercut coal-cutting machine.
1	25		Shunt	Driving a Sullivan 6-foot under-cut coal-cutting machine.
1	7.5		Compound	Driving through reduction gears a small hoist for elevating material used in mine to tipple.
1	5	1,600	Shunt	Belted direct to flywheel of a small Ingersoll air compressor, Type No. 77, running at 300 revolutions per minute, furnishing air at 95 pounds pressure.
1	5.25	1,600	Shunt	Belted through countershaft to a 20-foot 4-hanger line shaft driving a 12-inch forge blower; 12-inch emery wheel; and a 16-inch drill press.

conditions a system of regenerative braking may be employed—so designed that the weight of the descending carrier may be utilized to drive the motor as a generator, and thereby feed back an appreciable amount of current into the distribution system.

The intermittent service of hoists involves a necessity for certain precautions in resuming the operation of steam hoists after they have been shut down which are entirely absent when the electric type is used. If water collects in the cylinder of a steam hoist it must be thoroughly drained before starting the hoist to avoid the danger of blowing out the cylinder head, and in cold weather this is frequently complicated by the formation of ice in both the cylinder and pipe line.

The power losses represented by the drop in voltage in the electric conductors is practically negligible for the distances usually in coal-mine transmission when compared with the condensation losses in steam piping or the pressure losses in air lines over the same distances.

With steam hoists the exhaust steam practically prohibits any extended use underground, while the exhaust from the air-operated type introduces a factor that may have an adverse effect on the mine ventilating system.

The motor-driven hoist is the simplest and most compact form, inasmuch as the motor can usually be mounted on a common base with the hoisting drum and arranged to drive it directly through gears, thereby forming an entirely self-contained unit and effecting an economy in weight and in the amount of space required for its installation, which is often of appreciable importance when the hoists are located in the mine. Owing to the superior speed control of the electric type it has greater flexibility in operation and its extreme simplicity not only minimizes the cost of repairs, but obviates the necessity for the service of an engineer in running it, as the average worker is competent to receive the limited amount of instruction necessary and can be safely entrusted with its operation. Emergency demands on the ability of the operator are, as a rule, reduced by providing safety devices in the form of signal lamps, bells, or automatic cutouts, and for conditions such as those imposed by the use of motors for driving the type of water hoist commonly found in the anthracite fields, the hoisting equipment can be made entirely automatic in operation.

TABLE I.—COST BASED ON ONE MONTH OF 30 DAYS.

Items Included in Cost.		Total present Cost	Amt. saved with purchased Power
Three engineers at $85.00		$255.00	$110.00
Two firemen at $75.00		150.00	150.00
One helper at $50.00		50.00	50.00
500 tons of coal at 50c per ton		250.00	250.00
Oil, waste and packing		50.00	40.00
Boilers:			
Cost, including stack	$4,000.00		
Feed pumps	200.00		
Setting and foundation	800.00		
Feed water heater	400.00		
	$5,400.00		
Interest at 5 per cent		22.50	22.50
Depreciation 7 per cent		31.50	31.50
Repairs and upkeep		50.00	50.00
Insurance		10.00	10.00
Boiler Building:			
Cost $2,000.00			
Interest at 5 per cent		8.35	8.35
Depreciation at 5 per cent		5.00	5.00
Upkeep and repairs		5.00	5.00
Engines:			
Cost Two generator engines	$3,000.00		
Hoist engine	1,500.00		
Fan engine	600.00		
Elevator engine	200.00		
Screen engine	150.00		
Conveyor engine	100.00		
Pumps	400.00		
Machine shop engine	150.00		
	$6,100.00		
Interest at 5 per cent		$25.40	$25.40
Depreciation at 6 per cent		30.50	30.50
Upkeep and repairs		30.00	30.00
Building:			
Cost $2,500.00			
Interest at 5 per cent		10.40	
Depreciation at 5 per cent		10.40	
Upkeep and repairs		5.00	
Piping:			
Cost $1,500.00.			
Interest at 5 per cent		6.25	6.25
Depreciation at 7 per cent		8.75	8.75
Upkeep and repairs		15.00	15.00
Generator, switchboard and wiring:			
Cost $2,640.00			
Interest at 5 per cent		11.00	11.00
Depreciation at 5 per cent		11.00	11.00
Upkeep and repairs		15.00	15.00
Superintendence		25.00	
Taxes at 1 per cent of valuation (assessment 90 per cent)		15.00	7.50
Liability insurance at $1.33 per $100.00		6.05	4.15
Overhead		50.00	
Total cost		$1,165.45	$900.25
Fixed charges		284.40	
Operating expenses		881.05	

The power losses involved in the operation of an engine-driven breaker are unavoidably great, due to the complex mechanical transmission of the energy through numerous shafts, pulleys, sprockets, sheaves, belts, ropes and chains interposed between the prime mover and the machinery actually performing useful work, and which, in addition to consuming a large proportion of the available energy occupy a very considerable amount of space and serve to complicate the internal arrangement of the breaker. Owing to the severe service conditions the belt renewals and general repair work constitute a continuous and heavy expense and very little saving in the primary power required is possible when the breaker is operating on partial loads.

A realization of the inefficiency of engine drive has led some of the coal operators to equip breakers of modern construction with individual motor drive, which, by eliminating a large percentage of the shafting, belting, etc., effects a great reduction in the power losses and maintenance charges, and by rendering it possible to run the various portions of the machinery independently, makes the power cost, when only part of the equipment is used, directly proportional to the amount of productive work.

The earliest attempt at individual motor drive was made with direct-current inclosed motors, and was only partially successful, as the intense vibration inseparable from breaker operation tended to cause commutator troubles.

In those breakers where induction motors were used, the simplicity of the rotor and the absence of moving electrical contracts resulted in a practically complete immunity from motor troubles, and the breakers were supplied with current from a central generating station; no local reserve power plant being required.

For driving tipples individual motors have heretofore been more generally used than in breakers, and the typical modern steel tipple is usually equipped with separate motors for the conveyors, picking tables, screens, crushers, etc., although in some cases they are driven in groups by one or more large motors.

When long conveyor or scraper lines are used the power waste inherent in rope transmission may be reduced by using a centrally located motor or individual motors for separate sections. If extensions to the system are made, as in the case of conveyor lines to culm or refuse piles, the additions may

be made without interfering with the operation of the original equipment, by providing a separate motor for each new section.

All the surface auxiliaries of mines and collieries will, as a rule, benefit from the adoption of electric drive, which abolishes the necessity for separate power plants for distantly located washeries, slush dredgers, storage cranes, etc.

Central-Station Versus Isolated Plant Supply.

A few years ago it would have seemed almost ridiculous to intimate that central-station service could successfully compete with isolated-plant service for the operation of coal mines. Today, however, many mines, of all types and sizes, are purchasing power and the results being achieved, indicate that within the next five years a majority of the coal mines in this country will be operated by central-station power.

In connection with the use of central-station power, attention is called to the many prominent installations on the lines of the West Penn Electric Company in the Connellsville (Pa.) district. The territory served involves some of the worst conditions to be met in the way of drainage and hoisting. Considerable activity, also, is evidenced at the present time in other fields, notably the installations being made by the Appalachian Power Company in the Pocahontas coal fields of West Virginia. Also by the Pennsylvania Central Power Company, of Altoona, in the Cambria County fields, and by the Public Service Company of Northern Illinois in the Illinois fields.

Several typical installations recently made by the Appalachian Power Company are described in detail in the accompanying data sheets. The rate charged by this company is as follows:

POWER RATES OF APPALACHIAN POWER COMPANY.

A fixed monthly charge of fifty cents per horsepower of connected motor load (Manufacturers' rating) plus a meter charge as follows:

First	25,000 kilowatt-hours per month	@ 1.07 cents per kilowatt-hour.
Next	50,000 kilowatt-hours per month	@ 1.02 cents per kilowatt-hour.
Next	100,000 kilowatt-hours per month	@ 0.97 cents per kilowatt-hour.
Next	200,000 kilowatt-hours per month	@ 0.92 cents per kilowatt-hour.
All over	375,000 kilowatt-hours per month	@ 0.87 cents per kilowatt-hour.

In general, the advantage of central-station power may be stated as follows:

(1) Lower cost of operation. (2) Worry and care of power plant removed. The legitimate business of a coal operator is to mine and ship coal, and he should not try to carry on another business of so different a nature, at the same time. The efficiency of his plant will be greatly increased if he can spend his entire time in looking after the mining and shipping of the coal. (3) Reliability, which means greater production. (4) Much less expense involved in shutting down mine. (5) Capital needed for new power plant can be used for new development. (6) Increased output and additional power can be obtained quickly with of production on account of increase of efficiency, due to ample power at all times. (8) No change in speed of fan and pumps due to steam pressure falling occasionally. About the only disadvantage is that additional capital is often required with which to purchase new apparatus, but when the large returns in the shape of decreased operating expenses are shown, this capital is not difficult to obtain.

Some specific information on comparative costs of power was recently presented before the American Institute of Electrical Engineers by Graham Bright. In a certain shaft mine, having an average output of 1,100 tons per day, the costs presented in the accompanying table (Table I), were calculated, the respective savings also being shown.

It will be seen that the total cost per month is $1,165.45, of which $284.40 is a fixed charge and $881.05 the operating expense. The saving per month with purchased power is $900.25. Since the total of kilowatt-hours per month is 50,640, the total cost of power per kilowatt-hour is $0.023. The saving with purchased power will be $0.0178 per kilowatt-hour.

Commercial Practice
Management, Rates, New Business

Sign Campaign in Nashville.

"Advertising advertising" is the profitable occupation of the Nashville Railway & Light Company, of Nashville, Tenn., these days. The public service corporation in the Tennessee capital has commenced a striking newspaper campaign to exploit the electric sign and its advantages for the advertiser in any class.

Quoting an able authority in the field of exploitation, the Nashville Railway & Light Company says, "It is not the greatest amount of light that draws the crowds; it is the most interesting light." Developing this idea in well-written "copy," the central station points to the fact that the average mercantile sign, electrically operated, costs less than $3.00 per week. Comparisons of the amount of publicity a similar expenditure would secure in other media are extremely interesting—from the sign booster's standpoint. The company has experienced excellent results with the campaign.

Large Contract With Steel Mills.

The Consolidated Gas, Electric Light and Power Company, of Baltimore, nas closed a contract with the Maryland Steel Company under which it will sell to the steel company 6,500 horsepower of electrical energy. The gas company expects to increase this to 20,000 eventually, as the power will supplant the use of steam under the boilers of the steel company. The gas company supplies the Baltimore Copper Company with about 6,500 horsepower. The steel company will use electric power in its machine blast furnaces, Bessemer open-hearth, rail and by-products departments.

Central-Station Service in Pattern Shop.

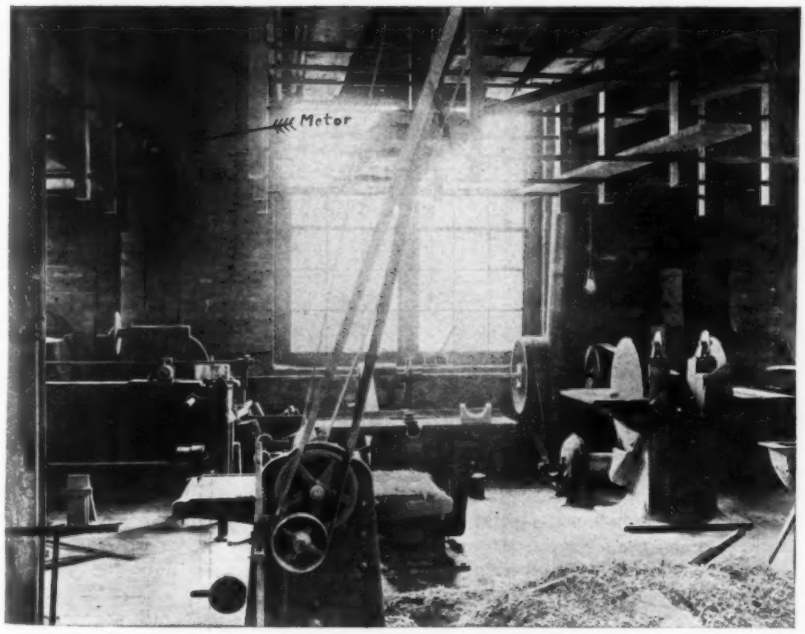
In the making of machinery and most mechanical devices, castings make up a large part of the work, and to make these castings, patterns are required. Exactness of size and shape is necessary and the pattern maker must make allowance in the construction of a pattern that need not be considered in other wood work, such as draft, shrinkage of the metal of the casting and in the machining of it.

The electric motor is especially suited to drive the high-speed tools used, and successfully meets the short periods of heavy demands as occasioned, for instance, when the roughing cuts on the pattern are made. For the balance of the lathe work when only fine cuts are taken, very little power is required, and for that reason some of

these machines can be well driven in small groups rather than by individual motors. The electric motor is the only logical source of power as the machine tools, joiners, grinders, saws, slotters, etc., can be driven individually or in small groups to the best advantage.

General View of Pattern Shop.

The accompanying illustrations show the motor installation at the pattern works of Charles Jurack, Milwaukee. In this plant there are a total of 22 machines and 10 motors, seven of the motors being used for individual drive while the other three drive small groups. All the motors except for the three saws are mounted on brackets about 11 feet above the floor, as can be seen in the illustrations. The motor driving the circular saw, seen in the foreground of the general view, is mounted on the floor, and has a wood inclosure around it. The two-band saws are driven by two-horsepower motors installed on brackets hung from the ceiling below. The method of driving by a short belt from below is very good if space on the floor below can be obtained. Watson 220-volt, three-phase motors of 1, 2 and 3 horsepower capacities are used throughout.



Motor Driving Group of Machines.

Because of its simplicity, and lack of moving open contacts, the squirrel-cage induction motor is admirably adapted, and this, especially so as the machines in the majority of pattern shops do not require motors of over 7.5 horsepower unless of course a large number are run by a single motor. The installation expense is low, as only a knife switch is needed to start them. Most of the machines start under no load, the motor reaching nearly its normal speed before load is applied.

As can be noted in the accompanying table the 16-inch jointer, the 24-inch planer, both rated at 7.5 horsepower, and the group consisting of drill press, slotter, two speed lathes, eight-foot post lathe and 12-foot post lathe are driven by three horsepower motors, although in the latter case of course, all machines are not in use at the same time.

By arrangements of the groups and individual drive Mr. Jurack has taken advantage of the best points of motor drive and through the use of the smallest possible size motor has reduced his demand charge. Motors of larger horsepower would increase the demand charge, and besides would be frequently operated at low efficiency and power-factor.

The wiring in this plant is principally of the open-knob style, but from the motor to the starting switch, iron conduit is used with a condulet fitting at each end. Conduit is the best construction when in the proximity of belts and shafting. The accompanying table gives the detailed motor installation. The average monthly consumption is 1,500 kilowatt-hours.

No.	Horse-Power.	Speed R.P.M.	Application.
1	1	1800	Belted to 6-inch jointer.
1	3	1800	Belted to 12-inch jointer.
1	3	1800	Belted to 16-inch jointer.
2	2	1800	Belted by short belt to band saws.
1	3	1800	Belted by short belt to 16-inch circular saw.
1	3	1800	Belted to 24-inch planer.
1	3	1800	Belted to 16-foot line shaft, driving two speed lathes, one drill press, two (8 ft. and 12 ft.) post lathes, and one slotter.
1	3	1800	Belted to 12-foot line shaft, driving four wood speed lathes and one emery wheel.
1	3	1800	Belted to 16-foot line shaft, driving a double disk grinder, one fan, one core-box machine, and one gear cutter.

Competitors in Business.

At the meeting of the Electrical Development League of San Francisco on March 3 there will be an address on "Our Competitors in Business," by Thomas Debevoise, of New York.

Electrical Construction

AN INTERESTING DESIGN OF ALTERNATING - CURRENT SWITCHBOARD.

Board for Control of Four-Wire Three-Phase Plant.

While much has been done in the last few years toward the standardization of switchboards, the cases are rather unusual where the best possible service can be secured in an electric power plant by adopting a standard design of switchboard, without making any changes in it. As a rule, it is wise to leave the selection of the switchboard until most of the other engineering details of the plant have been completely worked out and the character of the load the plant is to carry has been determined as definitely as it can conveniently be done, and then to have a board selected or built to meet the recommendations of some thoroughly competent electrician who is well informed as to what the operating conditions are going to be. It is true of small electric generating stations certainly, and often, perhaps, of large plants too, that the real efficiency of operation depends more upon whether the best design of switchboard has been chosen than upon almost any other electrical detail.

Thus it appears that the study of switchboard design for various classes of service is a most important one. It is certainly important enough to make a brief description of a board such as that with which this article is concerned worth while.

This switchboard, of which Fig. 1 is a front view, was built by Henry Newgard & Company, of Chicago, for the power plant in a Chicago manufacturing establishment. The load on the plant referred to consists of incandescent lamps and three-phase 220-volt induction motors. The source of electric power is two Crocker-Wheeler three-phase, four-wire, 60-cycle generators, the respective capacities being 150 and 428 kilowatts, at unity power-factor. The alternators are both star connected and the neutral wire is tapped off from the point where three armature windings are connected to each other, of course.

It is doubtless understood by the reader that the motors throughout the factory in which this plant is operating are all three-wire machines, the neutral wire of the generator circuits not being carried to the motors at all. In the lighting circuits, however, the neutral is made use of, and just how it is employed for this service, is indicated in Fig. 2. Three General Electric auto-transformers, connected as shown in the figure, are used to step the generator pressure down for lighting service. The arrangement employed here gives a lighting-circuit pressure of approximately 110 volts, the pressure between the neutral wire of either alternator and any other lead of the machine, being about 127 volts. By changing the connections on the secondary side of the auto-transformers to other taps than those now made use of, voltages slightly above 110 could be obtained in the lamp circuits.

It may be remarked, in passing, that in view of the fact that high-efficiency incandescent lamps designed for a pressure of 220 volts are now in very general use and may be obtained about as readily as lamps of other voltages, this design of circuits for lighting is especially interesting. It is stated that splendid voltage regulation on the lamps and service entirely pleasing in other respects is secured in this way.

As may be seen from Fig. 1, the switchboard consists of nine panels. The first two panels at the right-hand end of the board are exciter panels, and of these machines there are two, one of them having a rating of 30 kilowatts and the other of 20 kilowatts. The larger unit is steam driven, while the other is the generator end of a motor-generator set. As the motor of this unit, a three-phase induction motor is employed. When the alternators are started up again after having been shut down for any reason, the steam-driven exciter is drawn upon for exciting current until the motor-generator set can be started up, after which the two machines are thrown together on the exciter busbars for an instant, and then the steam-driven unit is pulled off and shut down. In the design of the plant it was not intended that there should ever be any attempt to run these two dynamos in multiple for a longer time than is needed to make the change-over mentioned. The field circuits are shown rather well in Fig. 2.

Fig. 1.—Front View of Switchboard.

Another interesting fact brought out in Fig. 2 is that the exciters may be used to supply current to certain lighting circuits in the factory. Panel No. 9 (Fig. 2) is the lighting-feeder panel, and switch *I* on this is a double-throw, three-pole switch with a set of lighting feeders connected to the central horizontal row of contacts. It is clear enough that throwing the switch to the downward position puts these lighting feeders on the exciter busbars, while throwing it upward connects them to the regular lighting busbars. An "I. T. E." automatic circuit-breaker is employed to protect the exciter at this point.

Most of the wiring for the switchboard instruments was left off the switchboard diagram—Fig. 2—beacuse to have included it all would have made the diagram practically unintelligible. These instruments consist of an ammeter for each exciter and a voltmeter for these machines; a Tirrill voltage regulator; one ammeter and one indicating wattmeter on each alternator panel; a synchroscope, an alternating-current voltmeter and a watt-hour meter—all three on panel No. 7; and a voltmeter on the lighting panel. Weston ammeters and voltmeters are used, while the watt-hour meter and the voltage regulator were furnished by the Westinghouse and the General Electric Companies, respectively. The voltmeter for the alternators, and the synchroscope are mounted on a special type of swinging bracket which keeps the scales of the two instruments in the same vertical plane and makes it easy to turn these instruments into any direction from which it might be desirable to read them, this bracket, and other special features of the switchboard, having been designed by Paul Augustinus, engineer for the builders of the switchboard, under whose supervision it was designed and built.

Except for the protection of the meters, all fuses on the board are link fuses, and they are all 200-ampere fuses. Where greater fuse capacity than this is required two or more fuses are connected in parallel. Thus large contact surface is provided at the fuse terminals. Moreover, this scheme removes the necessity of having to keep more than one size of fuse in the plant for making replacements.

The fuse studs are located on heavy copper blocks on slate slabs attached to the angle-iron frame which supports the switchboard panels. Through these copper blocks the switch studs pass, making good electrical contact with them. The switch studs are threaded throughout their entire length, so that the cable terminals threaded on them can be turned into such a position as to keep the cable vertical always. Where the studs pass through the slate slabs on which the fuses are mounted special provision is made to take all strain off the slate itself.

Fig. 3 is a rather good view of a

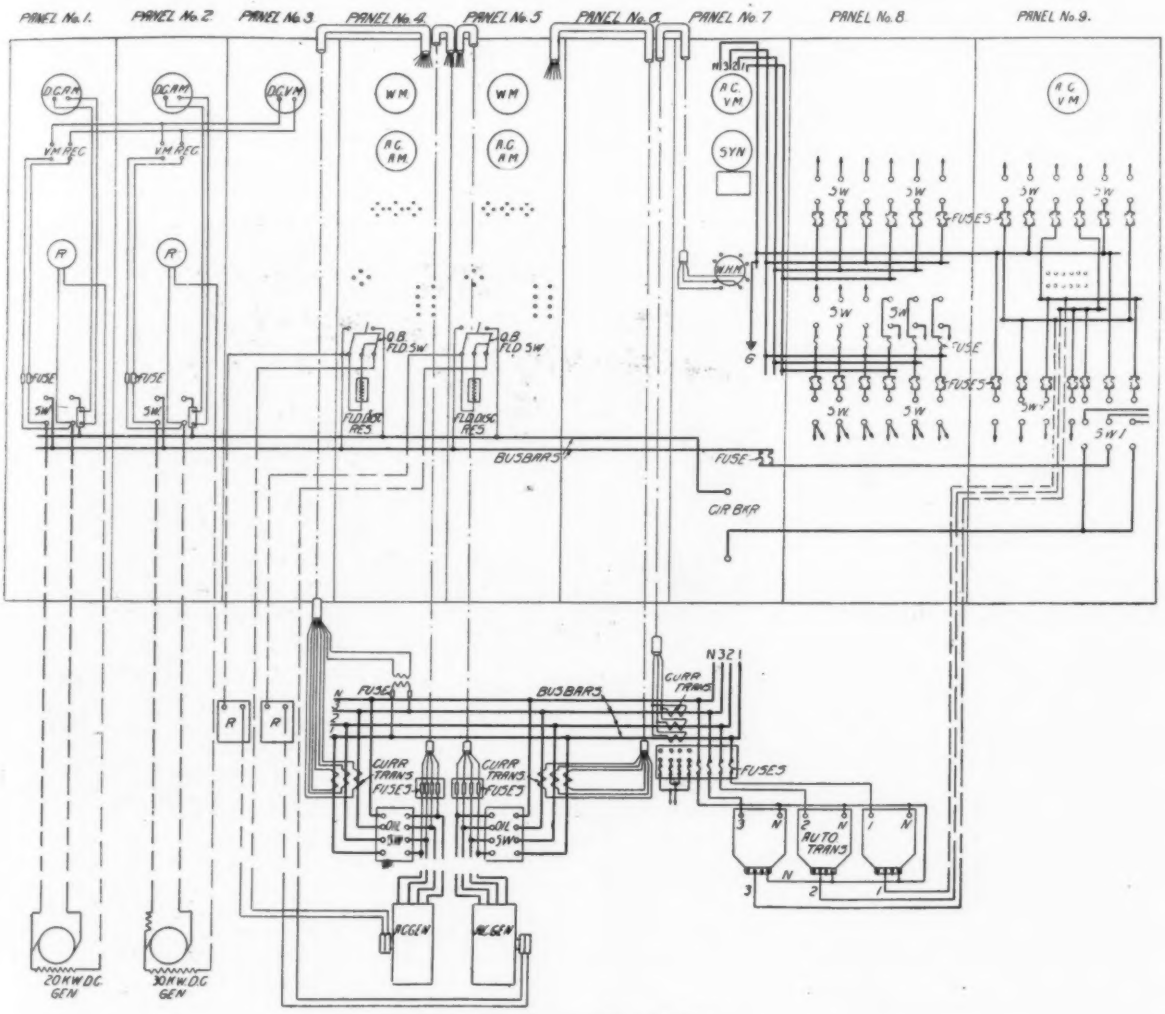


Fig. 2.—Diagram of Part of Wiring.

portion of the rear of the switchboard, and it shows also the angle-iron framework on which the alternator field rheostats and the alternator oil switches are installed. The rheostats were supplied by the Cutler-Hammer Manufacturing Company and the oil switches by the Condit Electrical Manufacturing Company.

These oil switches are rated at 500 and 2,000 amperes, respectively, but their actual capacity is evidently considerably in excess of this. They are non-automatic, of course. Each unit opens the circuit of its alternator very near the bottom of the oil tank, so that the weight of the oil tends to extinguish any arc that might occur, and the arrangement is such that the contacts are automatically kept clean. When the main contact is broken, on cutting a generator out of circuit, the break is temporarily shunted to an auxiliary contact, and here the final opening of the circuit occurs. Thus the wear of breaking the circuit, and of closing it again, as well, is taken by this auxiliary device, which can be readily replaced whenever such a procedure becomes desirable. The switches are operated through levers on the front of the board and links extending from here to the switch locations in the rear.

Fig. 3 also gives a very good indication of the character of the busbar work on the switchboard under consideration. It will be noted that from the oil switches to the back of the board they are run so as to leave room for a man walking erect, to pass under them readily. At the switches the neutral or grounded bus is the one nearest this passageway. Wherever bars are joined together, clamps, instead of bolts, are made use of, if the surface of contact on one side is more than six square inches. These clamps consist of iron plates held in place with brass bolts, brass being used in order to prevent the formation of complete magnetic circuits here.

The switchboard contains one blank panel, which is to be used in case circuits not needed now have to be added sometime in the future. There is also room on the rack which supports the oil switches and field rheostats for other apparatus of this sort. It may be remarked, in this connection, that money spent in thus providing for future additions when a switchboard is being designed generally proves to be a wise investment.

Wooden Molding Not Approved in New York City.

The municipal inspection department announces that after June 1 of the current year, the use of wooden molding in electric wiring will not be permitted in New York City.

Drying Out Electrical Apparatus.

The circumstances under which a thorough drying out of electrical machinery becomes necessary are comparatively rare, but when the need does arise, it is generally urgent, and should be carried out in an expeditious and efficient manner, according to a writer in *Power*. When apparatus has been submerged, it is important that as soon as the water subsides or the machine has been lifted out of it, the process of drying be commenced. If this be done the drying-out process will require much less time and there will be a better chance of success. If, on the other hand, the machine is left exposed to the air in a wet condition for a week or two, it has been found that in many cases no amount of drying will be effective, owing to the insulation having been destroyed. Generally speaking, flood water is dirty, containing mud and decayed vegetable matter, and when to this is added the oil which is always present around machinery, it is evident that a thorough washing is an essential preliminary. This should be carried out at once, before the mud has had time to dry, and it can scarcely be overdone. If there has been much oil about and it is found to have worked into the windings, benzoline or gasoline will be found effective.

These preliminaries having been completed, attention must be at once turned to the application of heat for drying. There are many methods of doing this, the choice depending upon their relative convenience. Coke fires, open or closed, steam heat and the passing of current through the windings may be used singly or in conjunction. If the machinery is small it may be taken apart and baked in the ordinary drying oven. This is the better course to take with field coils of all sizes and small armatures, but the proposition is rather a different one to that for which a drying oven is ordinarily used as the coils will be excessively wet and may require higher temperatures and a longer time. Ovens of this sort are operated on two systems—by heat alone at a temperature of about 200 degrees Fahrenheit, or by heat and a partial vacuum which tends to draw out the moisture. In the second case the heat required is lower, the effect of a temperature of 200 degrees Fahrenheit being about equal to 240 degrees where heat alone is used. In either case it may be necessary to extend the baking over several days, but it is impossible to speak definitely upon this point as circumstances vary so considerably and machines themselves are widely different in the effect that immersion produces.

Fig. 3.—View Showing Oil Switches and Method of Mounting Them.

Insulation tests should be made at intervals, and it will generally be found that while the insulation resistance rises fairly rapidly to thousands of ohms, progress is slower toward the end. When it is considered that the amount of water which has to be drawn out of a large machine after it is externally dry may amount to several gallons, it is clear that the operation may be lengthy.

If a machine is too large to take to the ovens it must be dried where it is and a certain amount of ingenuity is often necessary to devise satisfactory methods. The chief agents available are the coke fire (preferably inclosed),

the steam radiator and electric current. The machine should be dismantled to some extent so as to allow the hot air to penetrate easily to all parts, and it has been found a good plan to rotate the armature at about its normal speed so as to throw out some of the water by centrifugal action. In doing this it is important to make sure that no potential is set up, as the insulation might be broken down permanently. Hot air generated by a closed stove is preferable to the direct action of an open fire. To dry a machine in this way it should be entirely inclosed by a wooden structure, the joints of which are covered with stout paper to prevent leakage. The stove should also be inclosed with a flue pipe leading outside to the air, and if one or more small fans are placed in the right position, proper circulation (which is very helpful in drying) can be kept up. The same principle is applicable where steam radiators are used, but if timber is not handy an effective substitute will be found in a stout tarpaulin carefully arranged so as to prevent leakage. A temperature of about 180 degrees Fahrenheit should be aimed at, and it may be necessary to maintain this for several days.

Electrical drying by means of a current generated in or passed through the windings is usually a longer operation, but at times it may be the only method available. It is seldom applicable at the start, because it may cause damage by electrolysis if not by actual breaking down of the insulation. Until the latter begins to test out at a fairly high value, current at low voltage must be used, and according to the nature of the machinery this will be attained in different ways. Armatures may be dried by being short-circuited at the brushes and run slowly with a weak field. As the insulation improves, both the field and the speed may be increased until the highest safe temperature is attained. The danger point is about 300 degrees Fahrenheit, at which heat cotton commences to discolor.

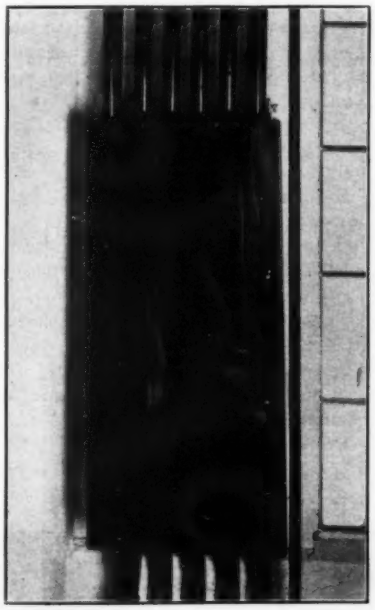


Fig. 2.—Cable Junction Box in Flour Mill.

The commutator often presents special difficulty, and it may become necessary to take it off and dry in an oven. If the insulation remains low obstinately this is generally the place to look for the trouble. Should it be preferred to pass current through the machine from an external source the armature should be kept rotating slowly as this will tend to more uniform drying, particularly of the commutator.

Transformers are difficult to dry out when thoroughly wetted, owing to the depth of their windings, and to assist matters it is well to remove any external insulating wrappings. A low-voltage current should then be passed through the high potential coils, the low potential side being short-circuited.

Modern underground cables if properly installed are fairly proof against damage by water. A good lead-covered impregnated paper-insulated cable if well jointed with water-tight boxes will suffer no harm, and should the water find its way in, it is usually only necessary to cut off a few yards at the end where the water will be found to have penetrated in between the core and its immediate insulation. Rubber cables unprovided with a lead sheath will not stand so well unless they are thoroughly water-proofed and quite new. The insulation of an old rubber cable is quickly destroyed by water and it cannot be repaired.

A 2,300-Volt Motor Installation in Flour Mill.

An interesting installation of high-tension power equipment is that in the new flouring mill of the Wasco Warehouse Milling Company at The Dalles, Ore. This mill represents the best of modern mill construction, not alone in electrical apparatus, but along all lines of machinery, building, etc. The main building is seven stories high and covers approximately 170 by 80 square feet of ground space. It is built entirely of reinforced concrete and steel.

Fig. 1.—Motor for Main Drive in Flour Mill.

Fig. 3.—Fifty-Horsepower, 2,300-Volt Motor Installed on Ceiling.

The present capacity is 1,300 barrels per day, and the ultimate capacity will be 2,750 barrels.

The power equipment now consists of General Electric, three-phase, induction motors of the following capacities; it will be duplicated with the final installation of motors in the mill. Except those used for driving the elevators and the sprinklers, all motors operate at a pressure of 2,300 volts. See table on next page.

No.	Application	Horse-power
1	Main Drive	300
1	Cerial Mill	15
1	Barley & Graham Mill	50
1	Wheat Receiving	35
1	Wheat Scouring	35
1	Wheat Scouring No. 2	15
1	Flour Packers.	15
1	Feed Packers	15
2	Humphrey Elevators	3
1	Automatic Sprinklers	5

The wiring and installation of power and control apparatus were carried out with a view to continuous service and ease of handling. The control of all motors is centralized on a switchboard located in a separate room especially designed for the purpose, the switchboard consisting of eleven standard panels, each one of which is 24 by 72 inches in size. On these are mounted all oil-break, overload switches, with relays, etc., each switch being equipped with signal lamps, enabling the attendant to see trouble that might occur in any portion of the mill.

The compensators, except the main drives, are located at the motors, and these are, of course, equipped with no-voltage protection, and are all mounted on steel-frame hangers especially designed for the concrete columns nearest their respective motors. All compensators were ordered, and designed for conduit entrance, and all outlets are either potheaded or inclosed in steel inclosures. The conductors to each motor in the building are entirely separate circuits, and no two motors are dependent on any one set of protective apparatus, with the exception of the main oil switch, which controls the entire load of motors. The conductors all consist of multiple, 5,000-volt, lead incased, varnished-cambric insulated cables, drawn into galvanized conduit buried in the concrete during the construction of the building.

All motor frames are grounded as is the entire conduit system. The lead sheath of the cables, and all metal parts of all switches, compensators, etc., are grounded separately as extra precaution, and as a protection to operators and to the system.

The various power circuits terminate at the switchboard in a terminal trough built of heavy angle iron and No. 10 gauge steel, and this box is equipped with heavy fiber brackets upon which the cables are laid separately as a protection to other circuits.

From this terminal trough the various circuits are extended down in conduit to the switch terminals and potheaded directly above each switch.

All protective apparatus is provided with separate potential transformers, so that the failure of any one device does not, in any manner hinder the continuous operation of the balance of the mill during repairs.

From the above description, it will be readily appreciated that there is not an exposed current-carrying live part on any of the apparatus, which fact eliminates all possibility of accident to employees, and insures continuous service so far as the motors are concerned.

Fig. 4.—Main Switchboard.

The lighting equipment of the mill consists of approximately 200 Benjamin reflector units, 16 inches in diameter, and 100-watt Mazda lamps, giving an efficient distribution of light over the entire area of each floor. Besides the regular lighting there are numerous receptacles provided for attachment of extensions.

The power and lighting installation was designed and installed by the West Coast Engineering Company, 708 Couch Building, Portland, Ore., The building was designed by Bennes and Hendricks, architects of Portland. Power is furnished by Pacific Power & Light Company.

Among the Contractors.

W. A. Jackson Company, Chicago, Ill., has been awarded the contract for erecting a substation building with complete equipment for street lighting in Summit and Argo, Ill.

The Langstade & Meyer Construction Company, of Appleton, Wis., has been awarded the contracts to equip the plants of the Watertown Canning Company and the Maeathon Brewing Company for electric service.

The Finney Electric Construction Company has opened an electric store and shop in Garrett, Ind., and will do electric wiring and repairing. A full line of electric goods will be handled by the company.

The Peninsula Electrical Supply Company, of Daytona Beach, Fla., has just completed the electrical installation in the new Oyama Building at that place. The work is in conduit throughout.

Riely & Richert, a prosperous firm of electrical contractors of Kankakee, Ill., is doing the electrical work in the Hickey and the Drury Buildings, in Kankakee. These are thoroughly modern installations; conduit work is being installed throughout the buildings.

W. H. Rowe Electric Company, of St. Augustine, Fla., W. H. Rowe, manager, has just moved from 317 St. George Street to larger and more centrally located quarters at 9 Hospital Street, where an attractive line of fixtures and a stock of supplies will be carried.

G. A. Sieber, who has been conducting a prosperous electrical contracting business in Jacksonville, Ill., since 1889, has been awarded the contract for wiring the First Presbyterian Church Building, of Bridgeport, Ill., for electric lights and for one electric motor. Important jobs which Mr. Sieber is now installing include the electrical work in the Mason County Alms House, and that in the Jacksonville lodges of the Odd Fellows and the Knights of Columbus.

A contract for electric wiring costing $700 or more has been awarded the electrical department of Fred A. Clegg & Company, of Louisville, Ky. The latest acquisition of these contractors is the work of installing conduits throughout the new Hazelwood sanatarium of the Kentucky Anti-Tuberculosis Association, an institution which will be a model in every particular, and particularly with regard to its electrical equipment.

Special Rules in Force in the City of Newark.

The department of electrical inspection of Newark, N. J., requires that in the wiring of apartment houses and three-family residences a sub-main must be run to a separate cutout in each apartment, this sub-main to be not less than No. 12 B. & S. gauge for a two-wire system, nor than No. 14 B. & S. gauge for a three-wire system.

No pipes, wires or conduits of any kind may be incased in the fire-proofing surrounding any columns, girders or beams of iron or steel; these must be placed outside of such fire-proofing.

Wiring in Garages.

Rigid iron-conduit systems must be employed in garages, and all cutouts and switches must be inclosed in metal boxes placed at least five feet above the floor level. Switchboards and charging panels must be located in a room or inclosure provided for the purpose.

For portable lights, flexible cable designed for rough usage must be employed, this cord carrying the male end of ten-ampere pin-plug connector, the female end of which is hung from a cable of the same type securely attached to the cover of the outlet box and of such length that the connector will hang freely at least five feet clear of the floor. For all portable lights, keyless molded-mica sockets, equipped with hande, hook and guard, must be employed.

For charging, theatre-stage cable must be employed, this cable carrying the female end of a 50-ampere pin-plug connector, the male end of which is hung from a cable of the same type securely attached to the cover of the outlet box and of such length that the connector will hang freely at least five feet clear of the floor, the male end of the connector being protected against accidental contact by a shield or petticoat.

It is required that motors used in garages be of the inclosed type and located not less than five feet above the floor, or else must they be inclosed in an approved fireproof compartment, shut off from main building.

Screw Driver Blades.

Never use a screw driver with beveled working end; see to it that the flat sides are parallel and fit the slot. If the blade is too thin for some slots this will be better for the screws than if it is tapering in thickness. This refers especially to work with screws that must often be drawn and re-driven. The ordinary screw driver breaks out the edges of the slot, making it difficult to turn the screw in either direction.

Robert Grimshaw.

A MOTOR-DRIVEN POLE CHANGER.

By J. D. Lewis.

The firm for which the writer is working is operating a small telephone exchange which serves all the buildings in an industrial plant, and also a 20-mile line to Springdale and a 35-mile line to Spokane. Both these lines are heavily bridged, and trouble was experienced in ringing through satisfactorily. We felt that a new pole changer must be secured immediately, and none being available at that time, we set about to devise one which would serve the purpose.

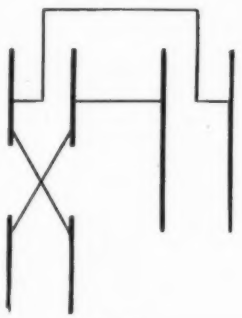


Fig. 1.

We took a small fan motor, designed for operation on 60-cycle alternating-current service, and on the end of the shaft of this we placed an extension, consisting of a short cylinder of hardwood of the right diameter to fit four flat rings sawed from a piece of 1.5-inch brass pipe. The rings were driven on the shaft, spaced equally and fastened in place with countersunk screws, the two next to the motor being sawed into halves, so as to make a two-segment commutator. The wooden cylinder was then drilled, so that alternate halves of the split rings could be connected together by means of wires run through holes in the wood, and also the solid rings connected to segments of the split rings in a similar way.

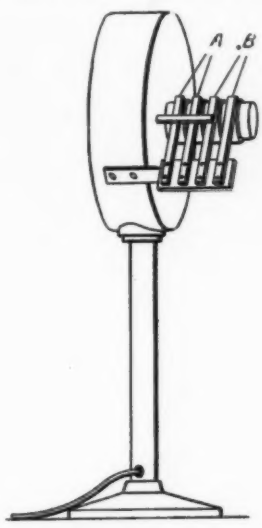


Fig. 2.

Fig. 1 shows how the rings were connected together. The two lines on the right represent the solid rings, and the other four lines represent the parts of the split rings.

Four copper brushes were mounted on a support attached to the motor frame in the manner indicated in Fig. 2, the brushes being well insulated from each other, and each brush bearing on one of the brass rings so as to make good electrical contact. To rings *B* in Fig. 2 we connected a 110-volt direct-current circuit. Then when the fan motor was set running we obtained alternating current, of course, from the circuit connected to the brushes on the split rings *A*. The speed of the motor being 1,800 revolutions per minute, the frequency of the alternating current obtained was 30 cycles per second. This low-frequency current was carried to the telephone switchboard and put on a ringing key, a 16 candlepower lamp being used in series in order to prevent excessive current in the ringing circuit. The motor itself is driven from the 60-cycle supply, and the outfit has been in operation for two months now with very satisfactory results; it works very well.

The writer does not think the practice of making substitutes for standard appliances is generally advisable. But in this instance it was a proposition of devising something very quickly that would do the work, out of such apparatus as was at hand.

Louisville Contractors.

The 1913 officers of the Louisville Electrical Contractors' Association, recently elected, are pretty nearly the same able folk who officiated with marked ability in guiding the affairs of the organization during 1912. F. E. Good, manager of the electrical department of F. A. Clegg & Company, has been re-elected president. Chris C. Childers, of Childers & Waters, has been re-elected vice-president, and Gus Albrecht, of Albrecht & Heick, who has acquitted himself very creditably as secretary of the association during one term, was re-elected for the ensuing year. Edward Thirlwell, president of the Marine Electric Company, and one of the new members of the association, has been elected treasurer for 1913. The appointment of standing committees for the year is to be announced by President Good at a later meeting.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
JAMES BENNETT, vice-president, 524 Coristine Building, Montreal, P. Q.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, National Conference Representative, 11 Wareham Street, Boston, Mass.

Executive Committee:

H. S. WYNKOOP, chairman, 13 Park Row, New York, N. Y.

Frank R. Daniel, R. P. Strong, Henry E. Knight, Washington Devereux, James B. McCarthy, W. Lincoln Smith, James Bennett, C. W. Mitchell, George L. Collison, T. H. Fritts, James S. Meade, T. Henry Day, James E. Cole, Thomas D. McColl

Secretary's Message.

Each member of the Association should now have in his hands a copy of Mr. Sweetland's bulletin of proposed modifications of the Code. Those members who propose to attend the Convention in New York will be able to discuss the matters there, but the Secretary desires to state that if those who are unable to attend have any comments, criticisms or recommendations to make in regard to any, or all, of the changes, and will write them out and send them to him, he will see that they are presented at our meeting and given due weight and consideration. This action he earnestly urges, not only as a means of getting opinions presented, but for the good effect it will have upon the discussions as a whole.

The Secretary again desires to call the members' attention to the fact that his recent circular letter had attached a statement of dues unpaid. This item appeared on about thirty of the circulars. To date, he has heard from only six of these thirty. It is extremely important that this matter be attended to so that the Secretary may have the dues in hand when he makes his report at the Convention. It does not seem quite fair to let the dues run behind (unless the intention is to withdraw from the Association, in which case notice should be given). Please attend to this matter at once; it is important.

A Committee for the Convention has been appointed, with H. S. Wynkoop as chairman, who has appointed subcommittees as follows—on the meeting: Messrs. Day (chairman), Cole and Smith; on the dinner: Messrs. Wreaks (chairman), Braddell, Hornsby and Fravel; on publicity, etc.: Messrs. McCarthy (chairman), Collison and Spence. As soon as these committees have completed their plans I shall notify the members of arrangements.

In regard to Question 220 in this issue, the questioner seems to intend to draw a distinction between the mechanical and electrical nearness of the wires. Of course, the screws do not modify the mechanical separation at all, but they do reduce the electrical distance to twice the distance between the copper conductor and the nearest surface of the screw. This might sometimes be just sufficient to determine the path of a lightning discharge, though I admit the probability is perhaps remote. Other possibilities may be thought of.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Here follow answers to Questions 216, 217 and 218, code letter M, which were received about twenty minutes too late to be included in the copy for the issue of February 15, in which the rest of the replies appeared.

Question 216.

Answer 9 (M). Bushings should be provided. However, in spite of the fact that flexible tubing bushes the holes where wires lead into switchboxes, there is frequently sufficient slack to allow the wires to come in contact with the metal of the boxes. The condition given in the question is no more than this. Nor, to my mind, is it worse than placing wires without additional insulation in a metal fixture, which, in many cases, has no more insulation from woodwork than has the switchbox.

Question 217.

Answer 9 (M). Rule 19*b* requires that the cutouts be inclosed when installed under certain conditions. This would indicate that it is not necessary to inclose them under all conditions.

Question 218.

Answer 9 (M). The first paragraph of Rule 23*d* would permit such an installation only when the total load did not exceed 660 watts.

Placing Service Pipe in Wall.

Question 219. Frequently our consumers object to the installation of an iron service pipe on the outside of the building, the objection being made on the grounds of poor appearance only. In such cases it is frequently suggested that the pipe be run behind the lath and plaster on the outer brick wall, or, in some cases, in a channel left in this brick (or concrete) wall. In each case the main cutout and switch are in the cellar, and the outer end of the service conduit is protected against moisture by means of the usual pipe and fitting. Are either of these forms of construction permissible under the Code?

Answer 1 (P). I cannot find that the Code covers this point specifically; but in this territory we would permit the service pipe to be installed in masonry wall, but would not allow it back of lath and plaster or weatherboarding. The reason, of course, lies in the fact that many of the service lines are not protected by fuses.

Answer 2 (O). This question brings up the hazard of unprotected service wires, which has been under discussion for several years. The experience of a number of inspection departments has shown that the Code rules are in need of amendment to guard against this danger. Until such amendments are obtained Rule 23*a* should be inforced literally, and, on a conduit service, the

fuses placed immediately at the point where the service conduit comes through the wall of the building, not even as much as one inch of conduit being allowed between the inside of the wall and the service cabinet.

Under this construction of the rule, I would answer the question by stating that neither of the proposed methods of construction complies with the Code, unless the channel in the brick or concrete wall is on the outside.

Answer 3 (H). I should say that the second construction suggested in this question is allowable under the Code, and a mighty good construction at that. We are using a great deal of it in this territory, with excellent success.

Answer 4 (E). In the first condition mentioned in the question, if the service cutout and switch were at the point of actual service entrance, within the building, then the installation would be in accordance with the requirements of the Code. If, however, the cutout and switch were in the cellar, then it would not be in accordance with the requirements of the rule. In the second part of the question, that is, that of channeling a brick wall, the problem appears to be somewhat different. Is the point of service entrance at the upper end of the service pipe or in the cellar? I am inclined to the opinion, and would so rule, that the actual point of entrance, under the second part of the question, is in the cellar and the place for the service cutout and switch would also be in the cellar.

Answer 5 (B). While personally I believe that a service pipe inclosed in a concrete or brick wall constitutes good construction, I do not believe that good construction would admit of a pipe being run behind the lath and plaster, or in an open channel in the outer brick wall; and, in so far as the Code is concerned, I do not believe either method is approved.

Answer 6 (F). If service wires enter at second floor and extend to meter board in basement, it is necessary to place a service cutout and switch at the point where wires enter building.

Answer 7 (M). We have a special rule on this, as follows: "Where service wires from overhead lines are brought into a building in conduit, this conduit should not be concealed in the walls of the building, but should be run exposed on the outside of building to a point opposite the location of the main fuses." I believe that where the conduit enters the outer side of the wall, it should continue directly on through the inner side, and not run concealed for any distance; otherwise the requirements of the first paragraph of Rule 23*a* will not be complied with.

Answer 8 (N). The first plan would not be allowed in this territory. The second would be, provided the channel were outside.

Answer 9 (K). It is the practice in this jurisdiction to permit the installation of a conduit service pipe in the outside masonry of a brick wall, where

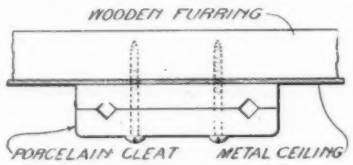


Fig. 1.—Sketch Illustrating Question 220.

such construction is desired for the sake of improving the appearance of the building. We do not permit the pipe to be carried down within the wall if it would be close to laths or other inflammable material. In a town outside of our territory we have noted the practice of running the conduit service down between the inner and outer sides of the walls of stucco houses,

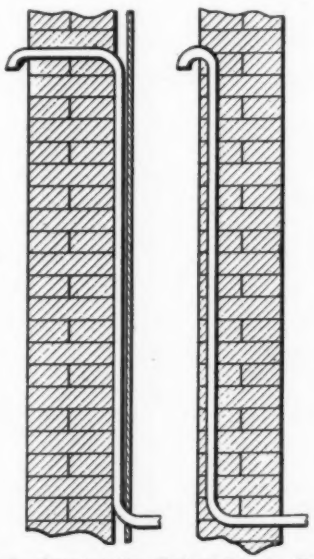


Fig. 2.—Construction Referred to in Question 219.

from the point where the wires reach the building to the cutout cabinet in the basement. This is along the line of practice referred to in the first part of the question, and we would not approve it. Grounds and short-circuits in service pipes are frequent enough to make this construction unsafe.

Use of Porcelain Cleats on Metal Ceiling.

Question 220. Is it permissible, under the Code, to use porcelain cleats for the support of wires on metal ceilings? It may be observed that the 2.5-inch separation between the two wires cannot be maintained, as the two screws enter the metal ceiling, thus reducing the distance between the wires. How is this matter treated by the other members of the Executive Committee, in their territory?

Answer 1 (F). Yes. The Code does not make any distinction between wood or metal ceilings, and the same conditions regarding position of screws exists when using porcelain knobs. At the point of support, it is almost impossible for wires to come in contact with each other.

Answer 2 (B). In our judgment, porcelain cleats of dimensions designed to maintain one-inch between wire and surface wired over may be used for the support of wires on metal ceilings. The ordinary half-inch cleat, though, we do not consider suitable. In many cases, where an embossed metal ceiling is installed, a half-inch cleat would bring wires in close proximity to the embossing on the ceiling.

Answer 3 (E). Practice recognizes and permits the use of porcelain cleats for the support of wires on metal ceilings. While, of course, the 2.5-inch separation is not maintained, still there is no possible chance, if the cleat be perfect, for the wire to come in contact with the screw. The separation distance applies more to wires between supports; that they shall not come in contact with each other there, is the intention.

Answer 4 (M). I would not consider such an installation permissible. If cleats are used they should be placed upon a running board or wooden blocks fastened to ceilings or walls independently of the cleats, and the screws which hold the cleats to the wood should not be long enough to enter the metal.

Answer 5 (O). Rule 26*h* calls for 2.5-inch separation between wires, without reference to the distance of the wires from screws, metal ceiling or other objects. Therefore, cleat work on metal ceilings is not subject to criticism under this Rule. The interpretation suggested by the question is not consistent with Rule 16*e*.

Answer 6 (P). Yes. The 2.5-inch separation between wires is not of particular importance at the cleat, but is essential midway between cleats; that is to say, in the centers of the spans where the wires are liable to come into contact through swaying. This idea is

clearly brought out in Rule 26*h*, second section.

Answer 7 (H). In rare cases where porcelain cleats are allowed on metal ceilings we insist upon their being placed on a wooden strip not less than 5 by 2 by 1 inches in dimensions, the supports for which are at least half an inch distant from the screws which hold the cleat, and countersunk into a wooden block. The screws which fasten the cleat must be not over one inch in length. This construction prevents any possibility of current passing through the screws to the ceiling.

Answer 8 (K). Yes; we approve the use of both single-wire and two-wire cleats on metal ceilings.

Answer 9 (N). In this territory I require a backboard, of such thickness that the screws holding cleats do not penetrate to the ceiling.

Legal Notes

FRANCHISES.

By Maguire and Mooney.

The question of franchises is becoming more complex because of the numerous methods in which the electric companies seek to protect themselves and of the privileges the municipalities seek in return for the right to use the streets, etc. With the modern tendency in the electrical field to develop and progress, many ideas are being continually introduced into the business that were unheard of a few years ago. For this reason and for the reason that in the future greater ideas will be developed, franchises must be drawn loosely enough so that the company may incorporate the new ideas into its business, and yet the franchise must be drawn sufficiently strong, so that the municipality may not avoid the obligation. There are three phases of franchise law that should be discussed—the creation of the franchise, the rights and duties of the company and municipality when the franchise is in force, and the forfeiture of the franchise.

A franchise is an extraordinary right emanating from the sovereignty. The power to issue franchises exists only in the state, except that the state authorities may delegate this power to various municipalities, and in most states the municipalities have authority to issue franchises. Nevertheless, while a franchise is an extraordinary privilege, it takes upon itself the nature of a contract, and it becomes an enforcement contract when accepted by the company. The matter of the proper rates to be charged by the company is the most important part of the franchise. This has been previously discussed.

In the operation of the company under its franchise, difficulties arise from time to time that are not easily solved by reference to the franchise. While

Upon acceptance, a franchise becomes a contract, and the company is bound by its provisions. Rebates may be made to the government, to charitable institutions, etc., without constituting illegal discrimination. Monopoly privileges cannot be used as a club to coerce customers in matters not directly connected with the service. Franchises should be carefully drawn so as to include all powers which it may be desired later to exercise.

it is well known that a company may make a rebate to a municipality along whose streets its wires are stretched, and which has large powers of control and regulation over its property, as a contribution to the expense and cost of government, has it the power to grant rebates to charitable institutions, etc.? A public-service company should not discriminate; it should serve all and not charge one patron any more than another for the same class and amount of service. To be sure, classifications respecting quantity and quality of service, are approved by the courts, but rebates contemplate reductions in charges where classification cannot affect it. The case of New York Telephone Company vs. Siegel-Cooper, 202 N. Y., 506, decided these points. The question presented therein was whether a company with an exclusive right to use the streets of a city in order to carry on its business, might make a discount of 25 per cent from its usual charges for service, in favor of the city itself, regularly incorporated charitable organizations, and regularly ordained ministers, without entitling all its patrons to a like discount for service of the same kind. A customer who was not so favored sued to recover the overcharge that he had paid. The favored classes did not compete with him in any business endeavor and there was no statement as to the effect of the discrimination or that it added appreciably to the cost of the general service. The court held that for time out of mind discounts had been granted by railroads and others conducting a business in which the public has an interest for services rendered to ministers and institutions of charity, because they are engaged in work of benefiting mankind and are supported by contributions from the public. Discriminations, the court held, could be properly made in favor of this class, because they benefit the people generally by relieving them of part of their burdens. A discrimination may only be defined as some advantage accruing to one man, in consequence of some wrong or injustice inflicted on another. Accordingly the rebates in question were permissible and the court so held.

Quasi-public corporations are required to serve the inhabitants of the territory in which they operate in the capacity for which they are organized, and in which they have secured a franchise, and they have the right to prescribe for their convenience and security certain reasonable regulations. The reason for this rule is that, although quasi-public corporations operating in cities under a franchise obtained from municipal authorities are organized for private gain, the consideration for allowing them to occupy the streets of towns and cities to carry on their business is that thereby the inhabitants of such municipalities may be furnished with conveniences and necessaries; hence, it follows that, in return for the right to install appliances in the public streets, they assume the duty to furnish the commodities to the inhabitants of the city without discrimination. Thus the right of an electric company performing two distinct kinds of service, to refuse to furnish one without the

other, was refused. The electric company was organized for the purpose of manufacturing and selling electric light, heat and power to the inhabitants of the city.—Seaton Mountain Electric Light, Heat and Power Company vs. Idaho Springs Investment Company, 49 Colo., 122.

Pursuant to franchises obtained from the city, the company installed its system, including pipes in the streets for the purpose of conveying steam heat to such as would purchase it. The electric company furnished this heat to the investment company for several years, and during this time the latter company was obtaining electric current from a rival company. The Gem Leasing Company, a distributing agent of the electric company in its heat branch, gave notice to the investment company that unless it purchased electric current from the Seaton Company it could not have the heat. The investment company then brought suit to restrain the company from enforcing its condition. The Seaton Company was organized for the purpose of manufacturing and selling electric light and steam or water heat, and must supply the inhabitants of the municipality subject to such rules and regulations as it may lawfully impose, but such regulations must be reasonable. The investment company was required by the rules of the electric company to take electric current for lighting purposes as a condition precedent to being furnished steam for heat. The court held that this was simply coercion, and an attempt on the part of the electric company to compel consumers to purchase electric current which they might not want nor need. If they could refuse to furnish steam because the customer did not purchase electric current, they could also refuse to furnish electric current unless steam were also taken. It is the privilege of the consumer to determine whether he desires one or all of the commodities which the company sold, and a condition imposing an obligation to take both or neither is not only unreasonable, but arbitrary, oppressive and discriminatory.

The whole trouble in this case was that the point was not covered by the franchise of the company, but was a regulation. If the regulation had appeared in the franchise all would have been satisfactory. But even at that it would seem entirely proper for an electric company that has some by-product to be given a preference in this manner. A grocer that sells some commodity at its cost price does so to attract other business and if that is all that is purchased by some customers the grocer cannot long exist. It seems that the practice of the company in this case was entirely along the line of economy and the disposition of by-products, and with its franchise amended so as to include that regulation the idea would probably have been approved. In the absence of some qualification made at the time a public-service corporation which undertakes to perform two distinct kinds of service is granted its charter, reserving to it the right to furnish one kind of service only when the other is furnished, it seems clear that no such right exists.

In the case of State vs. Butte Electric and Power Company, 115 Pac., 44, where it appeared that the company was empowered by its franchise to furnish electricity, it was held that refusal to serve electricity to anyone who stole its gas, until all reasonable charges for gas and electricity were paid, was unreasonable. The court, while holding that stealing gas was nevertheless a crime, determined that the company had no more right to use its franchise to protect its private gas business, than it would have to protect its private merchandise business. Upon the facts in the case the one who stole the gas was entitled to current on the same footing as every other citizen. He could have been prosecuted for the violation of the law, but the company itself could not assume to punish him for the violation of a rule which it had no power to adopt.

In the operation of companies the question of priority of the franchise is likely to arise. Between two companies it is always held that the one that has the prior franchise, is superior. Having the prior franchise it has the senior right upon the street and is entitled to as much space therein as is reasonably necessary for the safe and successful operation of its lines, including any additional space that it may have reasonably anticipated would become necessary in the future for the growth and enlargement of the business. One electric company, in the absence of the consent of the other, has no right to attach in any way its wires to the poles of another company, or to attach the wires of another company to its own poles.—Edison Electric Illuminating Company vs. Citizens Electric Company, 84 Atl., 438.

An ordinance of a municipality granting to a company authority to use the streets, alleys and public grounds of a city for the purpose of constructing and operating an electric light and power plant to furnish light and power to a city and its inhabitants confers privileges that are exclusive in their nature against all persons upon whom similar rights have not been conferred; and any person or corporation attempting to exercise such right without legislative authority or sanction invades the private property rights of the corporation to whom such franchise has been granted, and may be restrained at the instance of the owner of the franchise. The theory on which the law proceeds is that the owner of the franchise has a just right to prevent one who has no franchise, from acting in violation of law. And if an electric company has a franchise for supplying electric current to the inhabitants of a city, a street-car company may be enjoined from erecting a system of poles, wires, etc., in order to supply the inhabitants of the city with electric current.

Civil Service Examination for Electrical Draftsman.

The United States Civil Service Commission has announced an open competitive examination for electrical draftsman in the Isthmian Canal service to be held on March 19 and 20 at the usual place. The entrance salaries of the positions to be filled are $150 and $125 per month for first class and second class respectively.

Ratings are made on the basis of 30 credits for design, including arithmetic, algebra to quadratics, geometry, mensuration, logarithms, use of slide rule, elementary problems in mechanics, calculations in the fundamentals of electrical engineering, interpretation of formulas and the correct working out of special problems; 35 credits for drafting, including machine construction and electrical apparatus; 35 credits for training and experience. A rating of at least 70 per cent on the last item is necessary for eligibility, and those attaining 80 per cent will be rated as first-class draftsmen. Three years' experience in a good drafting room is necessary for a first-class rating and at least two years for a second-class rating. Technical-school training in electrical engineering will be accepted as equivalent to two years of practice. Applicants must be between the ages of 20 and 45 years. Examination form 1312 should be secured and filed with the Commission.

Electric Street Lighting Urged for Boston.

Commissioner of Public Works Rourke of Boston, Mass., in his annual report, urges the installation of electric lamps in place of the 11,000 gas lamps now in use for city lighting. Mr. Rourke says that 60-candle power tungsten lamps, giving one-third more light than the present gas lamps, cost $21.14 per lamp per year and their use would save the city $21,716 a year over the present contract price paid for gas lamps.

Synchronous Motors for Betterment of Service Standards in Water-Power Transmission.

A joint meeting of the Chicago Section of the American Institute of Electrical Engineers and of the Electrical Section of the Western Society of Engineers was held in the latter society's rooms, Chicago, Ill., on the evening of February 24, with R. H. Rice presiding. The topic for discussion was a paper by Lucius E. Andrus, superintendent of the Indiana & Michigan Electric Company, South Bend, Ind., entitled "The Application of Synchronous Motors to a Water-Power Transmission System for the Betterment of Service Standards."

This paper considers the use of synchronous motors purely from an operating standpoint and brings out some very interesting new methods of their application for bettering the speed and voltage regulation of a transmission system supplied from water-power sources. The paper deals chiefly with the practice developed by the Indiana & Michigan Electric Company in which a few years ago the taking on of some power load caused serious voltage fluctuations on the transmission line fed from two water-power developments. On account of the peculiarities of governors used in connection with waterwheel generators and of the importance of getting instantaneous response to sudden load fluctuations it is desirable to increase the flywheel effect of the generators. This, of course, involved heavy construction of the rotating parts, but is also improved through parallel operation. By operating three generators in parallel the reduction in speed by throwing on a certain load was reduced from 16 to 2.6 per cent, due to the greater flywheel effect of three rotors instead of one. By increasing of the load on the plant the fluctuations were further greatly reduced. Two old generators were used as synchronous motors to drive line shafts, to which were belted direct-current arc machines for street lighting. These also produced a material improvement in the speed regulation on account of the increased flywheel effect of the system.

It was next considered desirable to attempt to secure constancy of voltage at the generating and receiving ends of the line, allowing for a certain constant line drop. For this purpose it was found that by operating the synchronous motor so that it would give unity power-factor at about one-half the line load, at loads less than this it would supply wattless lagging current, which would artificially add to the line drop, while for loads above one-half normal line load the overexcitation of the motor would produce leading current, which would artificially decrease the line drop and thus secure constancy both of the generating and receiving voltages. It was found that automatic voltage regulators could be adapted to regulating the generator and synchronous-motor fields, so as to produce this desirable result. Mr. Andrus went into some detail to explain the characteristics of the motor that would be necessary for such service.

As the system grew additional water-power plants were developed and a large number of substations established. At the present time there are five generating plants and 25 substations, all of which are electrically interconnected. This large amount of electrical machinery, both of the synchronous and induction types, provides a very great volume of flywheel effect which serves admirably in holding the speed or the frequency of the system. Three synchronous motors are operating chiefly for voltage regulation. There are also a large number of railway substations in which are successfully installed 60-cycle synchronous converters. These are compounded to give as nearly as possible straight-line voltage characteristics, and although the load fluctuations of the railway system, which is very extensive, are quite violent they are not appreciably noticed in the voltage regulation of the entire network.

The discussion of the paper was opened by R. F. Schuchardt, who stated that the conditions found in the water-power transmission system described by Mr. Andrus were characteristic of such developments and the work of the author was therefore very valuable in pointing out means for very materially improving the regulation of such plants. The use of synchronous motors has frequently been advocated for regulating purposes but probably has never been used for waterwheel-speed regulation prior to Mr. Andrus' work. Mr. Schuchardt referred briefly to the substation practice of the Commonwealth Edison Company, Chicago, wherein better regulation was obtained formerly with the old frequency-changers, which were synchronous motor-generator sets supplying the 60-cycle distribution system from the 25-cycle transmission network. Since some of this load is now supplied directly from 60-cycle generators through transformers, it had been found that the regulation was not quite so satisfactory. It was improved therefore by operating the frequency-changer sets during peak loads.

E. W. Allen said that the cases described by Mr. Andrus were the first of synchronous motors for speed and voltage regulation. He thought that the use of synchronous condensers is usually of greatest value in increasing the capacity of a system by power-factor correction, then in improving the voltage regulation and lastly in improving speed regulation. He cited numerous cases in which these machines were used for improvement of the capacity. Although these machines are very valuable for all these regulating purposes the number of installations is unfortunately rather limited, however.

W. B. Jackson concurred in the statement that synchronous motors had been used for a long time for producing increase of capacity of a system, but prior to Mr. Andrus' work had not been used for combining all of the possibilities of the machine. He considered it extremely remarkable to be able to secure practically constant voltage on an extensive water-power transmission system. R. H. Rice said that this development probably would have an important bearing on making possible and even advisable the interconnection of extensive transmission systems.

E. H. Freeman expressed his belief that the order of the advantages of the use of synchronous motors will depend upon the conditions prevailing in any particular system. In some cases, such as water-power development, speed regulation is the most important and in such installations, therefore, these machines will probably be used chiefly, or at least very largely, for such regulation. In other cases constancy of voltage is the most important consideration and therefore the use of synchronous motors for this purpose will probably be a more important one than merely for power-factor correction. The latter is of value to the power producer, whereas the two former are of value to the consumer. Prof. Freeman felt that all of the advantages of the synchronous motor had not been made use of as generally as they should. While this doubtless was due to hesitancy on the part of operators because of a belief in the difficulty of operation of these machines, now since they are self-starting and easy to control they ought to receive very extensive application.

Mr. Drake described a plant in which relatively short transmission distances were employed and it was considered as to whether synchronous motors would improve conditions. It was found where distances are very short and therefore the investment in line copper is small, that it was more economical to run without these machines than with them. However, if the investment in line cop-

per becomes very great, the use of these machines becomes highly advantageous. He also referred to later extensions of the same plant which required the operation at times of turbo-generators operated without steam as synchronous condensers. It is perfectly feasible to do this if a very high vacuum is maintained in the turbine; otherwise it is necessary to run on a very small amount of steam to carry away the losses. Mr. Allen thought that it was not a good plan to operate such a unit without steam supply and it was probably better to supply a small amount of steam to make up the losses of the unit instead of supplying them electrically from the switchboard.

Mr. Andrus said that he wanted to emphasize the fact that in the system that he had described the synchronous motors were not used to correct power-factor but chiefly to regulate the speed and voltage. Induction motors also have an important influence in increasing the flywheel effect of a large system.

Invention for Land and Cable Lines Announced at Annual Meeting of Mackay Companies.

At the annual meeting of the Mackay Companies, held in Boston on February 15, an invention which is expected to mark a new and important era in ocean cable telegraphy, was announced. John Gott, who has been chief engineer of the Commercial Cable Company since its organization in 1884, has invented a device by which the Morse dot and dash signals can be used on long submarine cables. That is to say, messages can be sent by the ordinary land line Morse key and received on a Morse sounder. It is understood that the instrument surpasses in importance anything that has been added to the submarine cables since Lord Kelvin made practical the operation of long submarine cables 50 years ago.

With regard to the financial aspects of the Mackay Companies the trustees report as follows:

"The Mackey Companies has no debts. Its outstanding preferred shares ($50,000,000) have not been increased during the last six years. Its outstanding common shares ($41,380,000) have not been increased in the last eight years. No bonds, notes or stock have been issued and no debts incurred during the year.

"The income of the subordinate companies of the Mackay Companies is greater than is required to pay the dividends of the Mackay Companies, but its policy is to obtain from its subordinate companies only enough money to meet those dividends. The physical properties of the subordinate companies are maintained in excellent condition. All reconstruction is charged to operating expenses. Your trustees feel that your system is in so strong a position that the stability of your investment is assured.

"The twelve million dollars realized about three years ago from the sale of American Telephone & Telegraph Company stock is still preserved intact, in cash and in the highest class of securities, including New York State and city bonds, and this great fund is ready for emergencies and extensions."

The profit and loss account of the companies show that the receipts for the year ended January 1 last amounted to $4,136,009, an increase of $7,510 as compared with the year preceding. The amount carried to surplus was $36,665.

Sir Edmund B. Osler, a director of the Canadian Pacific Railway; Henry V. Meredith, vice-president of the Bank of Montreal, and George Clapperton, vice-president of the Commercial Cable Company, were added to the Board of Trustees.

The report further discusses the relations between the Postal Telegraph Company, the Western Union and the American Telephone & Telegraph Companies, and states that decisions of the courts and public service commissions have recently been in favor of the contentions of the Postal.

Western Electric Holds Big Exhibition and Sales Convention.

One of the most interesting and comprehensive sales conferences and exhibitions ever held in the electrical industry took place in Chicago last week. The Western Electric Company had on exhibition on the seventh floor of its big building at 522 South Clinton Street, Chicago, the detailed exhibits of 34 manufacturers of electrical apparatus of every description. There were about 150 of the Western Electric salesmen in attendance at a series of conferences during the week of February 24 to March 1, and both morning and afternoon the salesmen visited each exhibit in groups of three. Each salesman was required to investigate and go thoroughly into the selling points of every article on exhibition, and his apparent ability was checked by the manufacturer's representative in charge and a report with regard to his attentiveness, perceptiveness and general knowledge of the line turned into the sales managers each evening. Based upon the report made by the manufacturers' representatives upon the ability of the salesmen, the latter was passed on to work of another character or was sent back to the manufacturer for further elucidation, as the case might be. On Thursday afternoon there was an oral quiz when all of the salesmen in conference participated in a very thoroughgoing examination upon the subjects they had under study and discussion during the week. Friday morning there was a trip to the Hawthorne factory, and at 7:00 o'clock in the evening there was an informal banquet at the Chicago Athletic Club. On Friday afternoon and on Saturday the exhibit was open to the friends of the customers. The conference committee was in charge of Martin A. Oberlander, as chairman, assisted by Gregory Brown, F. A. Ketcham and F. B. Uhrig. The system of exhibits and methods of checking the salesmen's calls and the system for recording and analyzing the manufacturers' reports were developed and organized by Mr. Oberlander.

Doherty Interests Plan Big Developments in Colorado.

In an address delivered by Frank W. Frueauff of Henry L. Doherty & Company before the Denver Chamber of Commerce, Mr. Frueauff told some of the plans of his firm for the development of irrigation projects in the Denver district and other sections of Colorado. Mr. Frueauff stated that the Niles project, 60 miles from Denver, would be in working shape the present year, irrigating 27,000 acres of land, while the Redlands Mesa project, which will irrigate 700 acres, will also be complete.

Engineers of the firm are now investigating the Dolores project in Southern and Western Colorado. The land in this project to a great extent been released by the government, leaving the work now dependent upon the report to be made by the engineers. The Antero project, lying right at the doors of Denver, is practically completed and engineers of the firm say that water will be flowing on the land by June 15. This development will bring under cultivation 60,000 acres of land, part of which adjoins the city.

Maps prepared by the Doherty engineers show that at present there are 3,000,000 acres of land in Colorado under irrigation and cultivation, while there could be made available for irrigation and cultivation, by the combination of capital, water and colonists, 20,000,000 acres. The Doherty firm has acquired the reservoir system, the high-line ditch, the water rights, etc., of the Antero Land & Irrigation Company and will complete the system with the building of laterals and enlargement of reservoirs, which when completed will put water on 60,000 acres of land lying within fifteen miles of Denver.

NOMOGRAMS FOR ELECTRICAL PROBLEMS.

By M. J. Eichhorn.

One of the problems which occur most frequently in electrical work is to determine the size of wire that should be used for the purpose of carrying a given current or power a certain distance. In the case of direct-current local distribution systems the usual formula is comparatively simple, but of course it necessitates reference to a wire table giving the areas and carrying capacities corresponding to the numbers on the wire gauge. The nomogram shown in Fig 2 enables us to avoid both the numerical calculation and the use of the tables mentioned, because they are embodied in the graduation of the scales. The formula for which the nomogram is constructed is the following:

$$d^2/L = 10.79\ C/V;$$

in which d^2 = area of wire or cable in circular mils; L=length of wire, including both the supply and the return wire, in feet; C = current in amperes; V = drop in potential in volts. This formula is adapted for representation on a system of parallel scales by introducing an auxiliary variable A, such that $A = d^2/L$. This auxiliary variable may be considered simply as a stepping point in the calculations. By its introduction the proposed formula is divided into two equations, each having three variables, the first one being the one just mentioned, and the second:

$$A = 10.79\ C/V.$$

Now, by taking the logarithms of these expressions, we get:

$$\log C - \log V + \log 10.79 = \log A;\ \text{and}$$

$$\log A = 2 \log d - \log L.$$

Thus all the scales used are logarithmic scales and the two separate nomograms may be placed so that the scales for the variable A, which are identical in both, become superposed, as shown in Fig. 2. In addition the scale for L has been provided with a graduation, giving the distance between the points in miles and fractions of a mile, and the scale for d^2 a graduation, giving the numbers of the wire on the Brown & Sharpe gauge.

As the formula is in itself such that it may give for an answer a size of wire which is too small to carry the given current without overheating, a graduation has been added above the scale for the wire size, giving the safe carrying capacity for bare wires. On this graduation the safe carrying capacity in amperes has been placed directly over the size of wire to which it corresponds. The nomogram is read, like all of this character, by passing a straight line, preferably drawn or scratched on a piece of transparent celluloid, over the nomogram, as indicated by the dotted lines in the figure. The position of the dotted lines corresponds with the numerical example given. After reading the value of A the movable line is turned around the point on the middle scale as a pivot, and a second alinement is made on the other side of the nomogram. When the wire size has been obtained on the bottom scale, a glance at the scale for the safe carrying capacity will show whether it will be necessary to reject the solution so obtained, and take instead the minimum size capable of carrying the given current. The nomogram lends itself with equal ease to the solution of the equation, no matter which of the entering variables is taken as the unknown.

A very similar problem is the determination of the size of generator leads in a power station, having three-phase alternating-current generators, and a nomogram for this purpose is shown in Fig. 1. This nomogram is particularly intended to apply to cases involving large powers and high voltages, but of course similar nomograms may be easily constructed for any range. The formula in this case is:

$$I/W = 1/(\sqrt{3}\ E\ \cos\Phi)$$

in which I = current in each phase in amperes; W = power to be transmitted in watts; E = voltage of generator; $\cos\Phi$ = power-factor. In the same manner as in the previous case, the introduction of the auxiliary variable A permits us to divide the equation into two parts, and by taking the logarithms of the expressions involved, we get a pair of equations:

$$\log E + \log\cos\Phi + \log\sqrt{3} = -\log A;\ \text{and}$$

$$\log A = \log I - \log W.$$

These equations are such that each of them may be represented on three parallel scales and have their scale for A identical, so that they can be joined through this variable.

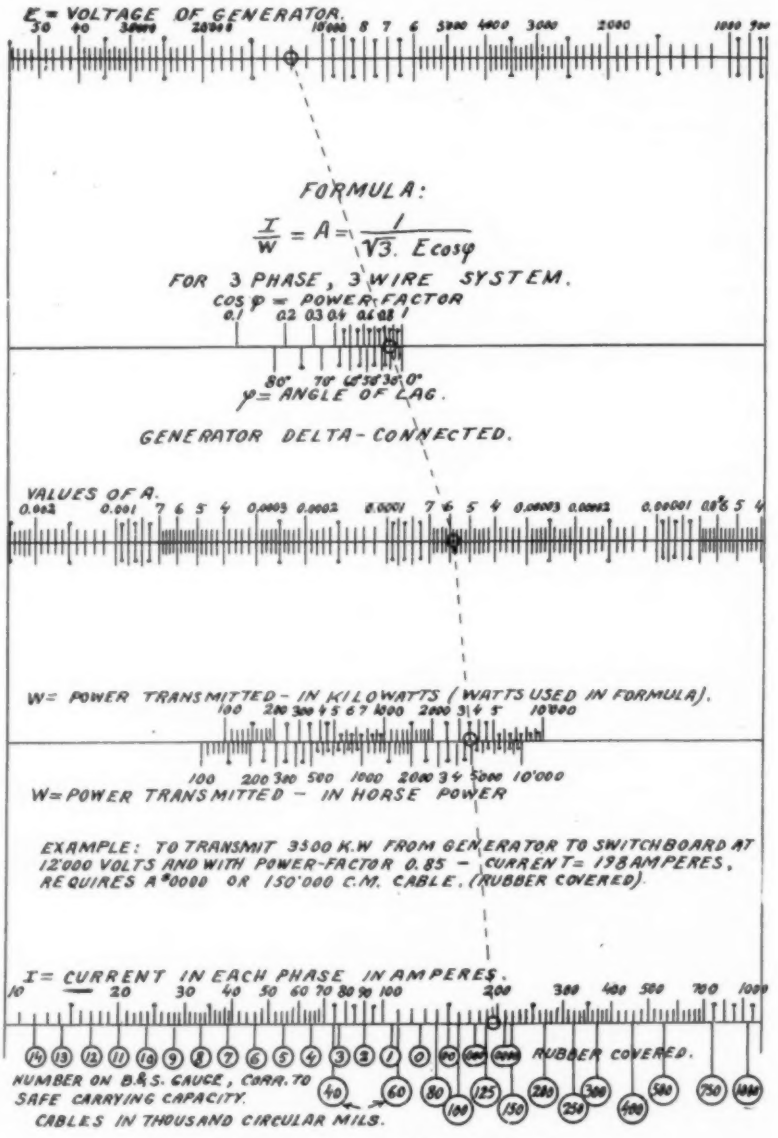

E = VOLTAGE OF GENERATOR.
FORMULA:
I/W = A = 1/(√3. E cosφ
FOR 3 PHASE, 3 WIRE SYSTEM.
COS φ = POWER-FACTOR
φ = ANGLE OF LAG.
GENERATOR DELTA-CONNECTED.
VALUES OF A.
W= POWER TRANSMITTED - IN KILOWATTS (WATTS USED IN FORMULA).
W= POWER TRANSMITTED - IN HORSE POWER
EXAMPLE: TO TRANSMIT 3500 K.W FROM GENERATOR TO SWITCHBOARD AT 12'000 VOLTS AND WITH POWER-FACTOR 0.85 - CURRENT = 198 AMPERES, REQUIRES A 0000 OR 150'000 C.M. CABLE. (RUBBER COVERED)
I= CURRENT IN EACH PHASE IN AMPERES.
RUBBER COVERED.
NUMBER ON B.&S. GAUGE, CORR. TO SAFE CARRYING CAPACITY.
CABLES IN THOUSAND CIRCULAR MILS.

Fig. 1.—Nomogram for Size of Generator Leads.

As shown in the figure, the scale for the power-factor has been provided with an additional graduation for the angle of lag; the scale for power has been graduated both in kilowatts and its equivalent in horsepower, and, finally, the wire sizes have been plotted in Brown & Sharpe gauge opposite their respective safe carrying capacity on the scale for current. These capacities are for rubber-covered wires and a second row gives the larger sizes of cables. In using this bottom scale, it must be remembered that the intersection point, that is found as the solution of the given problem, is always located on the graduated straight line, and the numbers given in the circles are to be considered as labels, indicating by the attached line the point to which they belong. This nomogram is used in the manner described above in the case of Fig. 2. It should also be noted that this nomogram applies only to the case of a delta-connected generator.

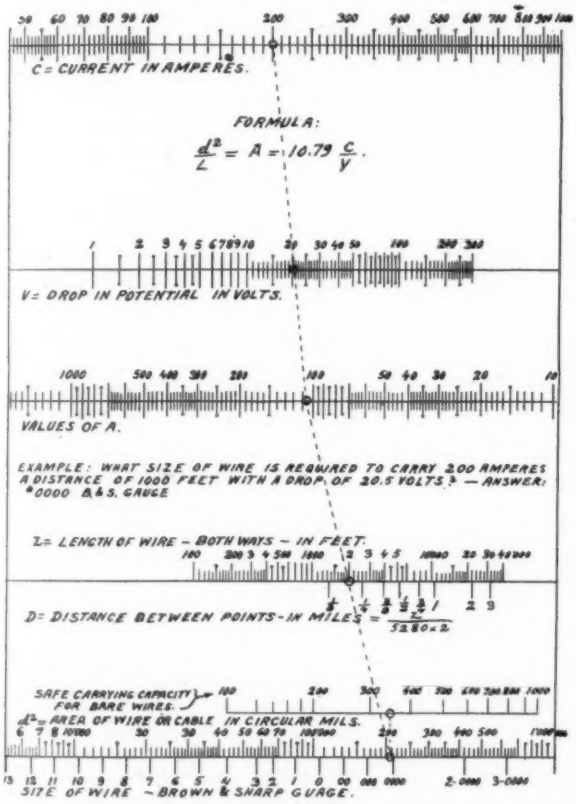

C = CURRENT IN AMPERES.
FORMULA:
V = DROP IN POTENTIAL IN VOLTS.
VALUES OF A.
EXAMPLE: WHAT SIZE OF WIRE IS REQUIRED TO CARRY 200 AMPERES A DISTANCE OF 1000 FEET WITH A DROP OF 20.5 VOLTS? — ANSWER: 0000 B.&S. GAUGE
L = LENGTH OF WIRE — BOTH WAYS — IN FEET.
D = DISTANCE BETWEEN POINTS IN MILES.
SAFE CARRYING CAPACITY FOR BARE WIRES.
AREA OF WIRE OR CABLE IN CIRCULAR MILS.
SIZE OF WIRE — BROWN & SHARP GUAGE.

Fig. 2.—Nomogram for Size of Wire for Direct-Current Transmission.

Another useful nomogram is shown in Fig. 3. It has been found in actual practice, that the prevailing forms of power-factor meter do not agree with the results obtained by calculation from the indications of the other switchboard instruments, in all probability because they may be affected by a change in the alternating-current wave-form in a manner differing from that of the others, or because the unbalancing of the three-phase circuit has such an effect, when the two-wattmeter method is used. For this reason it is advisable to disregard their indications and use only the calculated results, and by means of the nomogram the switchboard operator is enabled to put the power-factor in his record, as soon as he has read the other instruments. The nomogram is used by placing the movable straight line, indicated by a dotted line in the figure, so that it passes through the value of the current in amperes, as read from the ammeter, on the top scale, and also through the value of the potential in volts, as read from the voltmeter, on the second line, and then noting the point on the middle scale so indicated. The movable line is now turned around the latter point as a pivot, and so as to pass through the value of the power delivered, as read on the wattmeter, on the fourth scale, when the power-factor can be read on the lower graduation on the bottom scale. The upper graduation of the bottom scale indicates at the same point the angle of lag, corresponding to the power-factor.

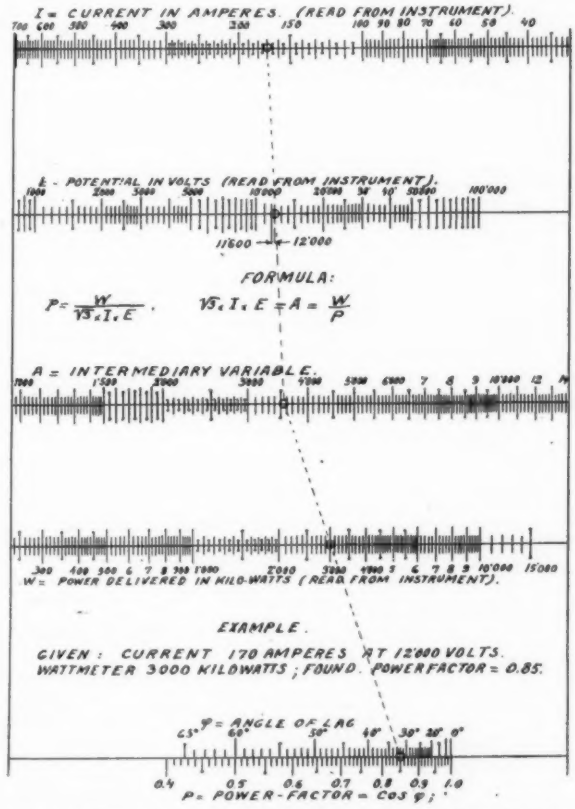

I = CURRENT IN AMPERES. (READ FROM INSTRUMENT).
E = POTENTIAL IN VOLTS (READ FROM INSTRUMENT).
FORMULA:
A = INTERMEDIARY VARIABLE.
W = POWER DELIVERED IN KILO-WATTS (READ FROM INSTRUMENT).
EXAMPLE.
GIVEN: CURRENT 170 AMPERES AT 12'000 VOLTS.
WATTMETER 3000 KILOWATTS; FOUND. POWERFACTOR = 0.85.
φ = ANGLE OF LAG
P = POWER-FACTOR = COS φ;

Fig. 3.—Nomogram for Power-Factor of Three-Phase Circuits.

The nomogram, as constructed applies only to three-phase circuits, but similar nomograms can of course be easily constructed for any other system. The formula used is:

$$P = W/\sqrt{3}\, I\, E;$$

in which P = power-factor; W = wattmeter reading in kilowatts; I = ammeter reading; E = voltmeter reading. By transposing and introducing the auxiliary variable A, we get:

$$\sqrt{3}\, I\, E = A = W/P.$$

By taking the logarithms on both sides of this equation, we get:

$$K + \log I + \log E = \log A = \log W - \log P;$$

in which K is a constant which only affects the relative location of the two upper scales lengthwise along the straight lines on which they are plotted, but does not affect the size of the scales nor their distance apart. Thus we see, that all the scales used are ordinary logarithmic scales, and it only remains to choose the range of the variables in the manner best suited to the conditions for which the nomogram is constructed. For a low-voltage distribution, for instance, it would be desirable to shift the voltmeter graduation to the right, and it naturally follows that the ammeter graduation on the top scale also must be shifted to the right, so as to preserve the alinement of the points connected by the dotted line in the figure. If, on the other hand, it is desired to construct a similar nomogram for a range of power smaller than 300 kilowatts, then it is necessary to shift the central scale for the intermediate variable to the right, and this necessarily changes the location of

the three scales in the middle, whereas the top and bottom scale may remain unchanged. The scale for the power-factor is in the nature of things of a very limited range, since it cannot be more than unity, and very seldom falls below 0.6.

N. E. L. A. to Collect Data on Conduit Work.

Because of the fact that the National Electric Light Association has received many requests for information respecting underground conduit work in this country, Secretary Martin has arranged with G. M. Gest to compile and record the cities of the United States and Canada which have underground systems, giving the nature and extent of the work.

Mr. Gest, who makes a specialty of conduit work, is corresponding with the managers of all electric-light plants for the information desired and when collected it will be turned over to the Association for its library and the use of its members. Secretary Martin urges that the requests for information should receive prompt attention.

Rejuvenation at Youngstown.

Youngstown, Ohio, is rapidly becoming a pronounced spot on the Jovian map. At the Rejuvenation in the city, February 27, 17 prominent electrical men became identified with the Sons of Jove. The Rejuvenation at the Elks' Club was followed by a Dutch lunch, at Hotel Salow, W. D. Shaller, Eleventh Mars, E. H. Sutton, Elliot Reynolds, James O. Corbett, statesmen-at-large from Pittsburgh, Frank M. Knapp, stateman from Pittsburgh, and R. B. McClean, statesman at Erie, witnessed the work of the Youngstown League and participated in the speech-making at the banquet.

Arthur Wright to Join Boston Edison Staff.

Announcement is made that the Edison Electric Illuminating Company, of Boston, has arranged to retain the services of Arthur Wright, of London, in a general advisory capacity. Mr. Wright is best known in this country as the designer of the Wright demand indicator, although as a matter of fact his principal work during the past 12 years has been in the construction and operation of large central-station companies.

Pittsburgh Jovians Celebrate.

The Pittsburgh Jovian Electrical League held its annual theater party in the Nixon Theater on the evening of February 14. The players of the company were told of the presence of the electrical men and made the most of their opportunity in merry jests at their expense. Following the theater, supper was served in the Fort Pitt Hotel.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

Convention at Chicago, February 18, 19 and 20.

The sixteenth annual convention of the National Independent Telephone Association was held at the Hotel La Salle, Chicago, Ill., on Tuesday, Wednesday and Thursday of last week. The convention sessions were well attended. The topics considered bore less on questions of general policy and more on technical matters than has been the custom in most previous conventions of this body.

The first session was opened Tuesday morning by President Manford Savage, who introduced a representative of the mayor's office to bid the Association welcome to Chicago. N. G. Hunter, of Wabash, Ind., responded on behalf of the Association.

Mr. Savage then presented his annual presidential address. In this he reviewed the general status of the telephone industry, which he found not much changed from a year ago. He discussed at some length the agitation generally prevailing for the curbing of the great trusts and pointed out the impossibility of maintaining any high efficiency in colossal and monopolistic organizations. He considered it absurd to strive for a universal telephone system; such a vast system is not practical. Regarding the extension of the jurisdiction of the Interstate Commerce Commission to cover telephone companies doing an interstate business, he urged that a more explicit definition of the exact extent of this jurisdiction be made by congressional legislation. He called attention to the conflicting conditions confronting independent telephone men in different parts of the country, these calling for action by local associations. Reference was also made to the need of steadfast support of the national association, and to the organization of the Telephone Service Association with which he urged the National Independent Telephone Association to co-operate.

On Wednesday morning the meeting was turned over to the Telephone Service Association, R. L. Barry presiding. J. W. Callahan, president of this association, spoke of its organization a few months ago to improve the operating and service standards of its members. A standard code of operating rules has been drawn up. The association acts as a clearing house of information for the improvement of all branches of the service.

F. L. Eldridge spoke of the detailed work undertaken by the Telephone Service Association, of which he had been a general field observer. Consulting engineering and practical advice had been given to many companies, operating schools established and speed of making long-distance connections improved.

M. H. Moffett, of the National Carbon Company, then delivered an illustrated lecture on the manufacture and care of dry batteries. This industry began about 30 years ago; now there are more dry cells made and used in this country than in all other countries combined. Mr. Moffett traced in some detail the manufacture of the carbon and zinc electrodes and of the "mix," and the assembly of the complete cell. The raw materials are all tested under strict specifications and the cells receive several tests of voltage and current during the more advanced stages of their manufacture. Precautions about series connections of cells were pointed out. Series-multiple grouping gives much more satisfactory and economical service than straight series grouping.

H. S. Durant, of the American Steel & Wire Company, read a paper illustrated by lantern slides on the manufacture of steel wire for telephone lines. He began with the mining of the ore and traced its progress through shipment, blast furnace, converter and rolling mill to thin rods. These are rolled into reels, treated with acid, then washed and finally treated with lime to clean, protect and lubricate for drawing cold into wire. The galvanizing is done by first heating the coil in a lead bath, cleaning in acid and finally passing through the zinc bath and wipers to make a smooth and uniform galvanized coat.

On Wednesday afternoon the meeting opened with a talk on advertising of telephone service by B. W. Borten, of the Taylor-Critchfield Advertising Company. Newspaper advertising, principally, was discussed. All advertising must be of high standard. The copy must combine the poster and the reason-why ideas. More money is wasted by not doing enough advertising than by overdoing it.

C. W. Winkler, of the Illinois Telephone & Telegraph Company, made a pointed talk on some of the commercial features of the telephone business. He spoke particularly of the methods used to increase the traffic and business of the independent telephone company in Chicago. There must be the closest co-operation between the commercial, engineering and traffic departments.

H. M. Beck, of the Electric Storage Battery Company, presented an illustrated paper dealing with the manufacture, care and maintenance of storage batteries. He described the stationary type of battery, its positive and negative plates and wood separators, and discussed the chemical process occurring in the cell, the ventilation of battery rooms, the best methods of charging, precautions to be observed, use of pilot cells, etc.

On Wednesday evening at the annual banquet there was an attendance of nearly 400. J. W. Callahan acted as toastmaster. Witty and brilliant remarks were made by a number of speakers and a corps of

professional musicians and entertainers enlivened the festivities.

It was nearly noon before the meeting began on Thursday. The Committee on Resolutions presented its report, which was adopted, including resolutions of thanks to various persons who had particularly contributed to the success of the convention. Another resolution recommended the continued co-operation of the Telephone Service Association with the National Association. The final resolution recommended the plan of a co-operative liability exchange for the consideration of those members seeking liability protection.

After a discussion of the need of further legislation defining the powers of the Interstate Commerce Commission respecting telephone companies, the service conference was resumed. A. L. Staderman, of Terre Haute, Ind., presented an illustrated paper discussing telephone transmission. He made a strong appeal for decreasing as much as possible terminal and line losses in order to improve telephonic transmission. The insulation must be high to keep the losses low. Although the transmission equivalents of cable and open-wire lines are well known, the central office and substation losses are very variable. The use of poorly designed equipment and the improper use of good equipment both cause many losses that should be eliminated.

An illustrated talk on various aspects of telephone traffic was made jointly by W. S. Vivian, Grand Rapids, Mich., and H. D. Stroud, Chicago. Among the many topics touched on was the need for accurate records of toll service and careful analysis thereof. Operators' schools produce excellent team work and therefore improve the service decidedly by acquainting the girls with their work and with each other. Direct toll circuits are much better than those involving switching. Accurate check of overtime and lost-call records is necessary to increase the income from toll business.

President Savage then resumed the chair. R. S. Butler, of the University of Wisconsin, presented a very brief abstract of a paper on business efficiency in which he recommended that scientific management should be begun at the top of an organization, instead of at the bottom, as some advocate.

The official tellers reported that the balloting for directors had resulted in the election of the following board for the ensuing year:

E. B. Fisher, Grand Rapids, Mich.; G. W. Robinson, St. Paul, Minn.; J. W. Callahan, Chicago, Ill.; N. G. Hunter, Wabash, Ind.; Manford Savage, Champaign, Ill.; H. D. Critchfield, Chicago, Ill.; Warren Pratt, Kearney, Neb.; J. B. Earl, Waco, Texas; H. C. Todd, Maryville, Mo.; E. D. Schade, Johnstown, Pa.; H. B. McMeal, Chicago, Ill.; W. J. Thomas, Shelbyville, Ky.; Richard Valentine, Janesville, Wis.; C. Y. McVey, Cleveland, O.; P. C. Holdoegel, Rockwell City, Iowa; F. B. McKinnon, Tonganoxie, Kans.; and L. D. Kellogg, Chicago, Ill.

The convention then adjourned. The new board of directors will meet March 3 to elect the officers and executive committee.

As usual a very extensive display of telephone and allied apparatus and supplies was made by the manufacturers. This occupied practically all of one floor of the hotel. Tuesday afternoon and evening were set aside particularly for inspection of these exhibits, which were made by the following companies or firms:

Addressograph Company, Chicago. Addressing machines.

Alexander Hamilton Institute, New York City. Literature on business training, especially for executives.

Alyea Manufacturing Company, Chicago. Indiana anchor.

American Electric Company, Chicago. Magneto and central-energy telephones, switchboards and specialties.

American Surety Company of New York, New York City. Surety bonds.

American Telephone Fire Alarm Company, Chicago. Telephone fire alarms, (Denio system).

Andrae, Julius, & Sons Company, Milwaukee, Wis. Telephones, switchboards, construction material and supplies.

Automatic Electric Company, Chicago. Automatic telephones and systems for all purposes, including train dispatching.

Butler Electric Company, Perry, Ia. Electrical apparatus.

Cracraft, Leich Electric Company, Genoa, Ill. Telephones, switchboards and apparatus.

Coffey System & Audit Company, Indianapolis, Ind. Accounting and audit system.

Cook, Frank B., Chicago. Telephone protective apparatus and supplies.

Corwin Telephone Manufacturing Company, Chicago. Interior telephones and private branch exchanges.

Cutter, Scott C., Oswego, Ill. Telephone specialties.

Dean Electric Company, Elyria, Ohio. Telephones, switchboards and parts.

Duplex Metals Company, Chester, Pa. Copper-clad wire.

Electric Appliance Company, Chicago. Telephones and supplies, especially wire.

Electric Specialty Manufacturing Company, Cedar Rapids, Ia. Wireless cable tester.

Electric Storage Battery Company, Philadelphia, Pa. Storage batteries.

Ericsson Manufacturing Company, Buffalo, N. Y. Telephones, test sets and supplies.

Everstick Anchor Company, St. Louis, Mo. Anchors and boltless clamps.

Gottschalk Waterproof Sanitary Transmitter Company, New York City. Transmitters.

Holtzer-Cabot Electric Company, Brookline, Mass. Telephones, parts, ringing machines and supplies.

Illinois Electric Company, Chicago. Conduit, wire and other electrical supplies.

Illinois Telephone & Telegraph Company, Chicago. Automatic telephone system in service.

Indiana Steel & Wire Company, Muncie, Ind. Wire and strand.

Kellogg Switchboard & Supply Company, Chicago. Switchboards, telephones and parts.

Leeds & Northrup Company, Philadelphia. Cable-testing apparatus and electrical measuring instruments.

Manhattan Electrical Supply Company, New York and Chicago. Batteries, telephone supplies and apparatus.

Matthews, W. N., & Brother, St. Louis, Mo. Anchors, cable rollers and other patented line specialties.

Monarch Telephone Manufacturing Company, Fort Dodge, Ia. Switchboards, telephones and equipment.

National Carbon Company, Cleveland, O. Dry batteries and carbon.

Nungesser Carbon & Battery Company, Cleveland, O. Dry batteries.

Oshkosh Manufacturing Company, Oshkosh, Wis. Construction tools, linemen's supplies.

Paine Company, Chicago. Paine expansion shell.

Reliable Electric Company, Chicago. Telephone and switchboard protectors, electric specialties.

Roebling's, John A., Sons Company, Trenton, N. J. Telephone wire and cable.

Specialty Device Company, Cincinnati, O. Bierce anchors and cable sleeves.

Standard Underground Cable Company, Pittsburgh, Pa. Copper and copper-clad wire and cable.

Stewart Brothers, Ottawa, Ill. Test devices, trouble finders.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Telephone apparatus, aerial and underground cable, switchboard equipment.

Swedish-American Telephone Manufacturing Company, Chicago. Switchboards, telephones and supplies.

Telephone Improvement Company, Chicago, and North Electric Company, Galion, O. Auto-manual and manual switchboards, telephones and telechronometers.

Telephony, Chicago. Telephone weekly.

Thompson-Levering Company, Philadelphia. Electrical measuring instruments.

Utilities Indemnity Exchange, St. Louis, Mo. Inter-insurance on public-utility plants.

Vote-Berger Company, La Crosse, Wis. Drive and twist anchor.

Warner Electric Company, Muncie, Ind. Pole-changers.

BOOK REVIEWS.

"The Elements of Heating and Ventilation." By Arthur M. Greene, Jr. New York: John Wiley & Sons. Cloth, 324 pages (6x9 inches), 223 illustrations. Supplied by the Electrical Review Publishing Company for $2.50.

Professors in engineering schools, the practicing engineer and architect, and the wide-awake central-station manager will welcome this book in which Professor Greene takes up in a very clear and concise manner the problems arising in connection with the proper design and installation of heating and ventilating systems; and has collected together formulas, curves, and tabulated data which those called upon to solve such problems will find of great value. Heating by steam, hot water, heated air, electricity and gas are illustrated and described; and various present-day methods of ventilation are taken up, including the application of the electric ozonator for the purification of air for public buildings. Careful attention is given to the question of the quantity of air required for proper ventilation; also to the determination of the moisture content, the proper application of humidifiers and the installation of air washers. One full chapter is devoted to heat losses by transmission through the various materials of building construction. This chapter contains valuable tables showing the British thermal units transmitted by such materials per square foot per hour per degree difference in temperature between surfaces. Other chapters illustrate and describe standard forms of cast-iron radiators and heating coils for both direct and indirect heating; control valves in general use; vacuum return systems and their specialties; methods employed to determine necessary amount of radiation to suit various conditions; proper pipe sizes, etc., for both steam and hot-water systems. Sizes of registers and the design of flues for hot-air heating and ventilation are taken up in detail, together with speed and power requirements of fans for forced circulation and exhaustion of air. Various forms of steam, hot-water and hot-air furnaces are fully described, and tables and dimensions of the best known types are given. Formulas have also been carefully prepared for determining chimney details and smoke-flue sizes. The final chapters are given over to the problems of district heating from central plants, going fully into the approved methods of distribution, proper pipe sizes and the general design of such systems, and illustrating the various forms of underground construction and installation which have been most successful in this line of work. The details and application of temperature-control apparatus are given consideration; and formulas are also given for determining the proper temperature and quantity of air required for drying purposes in connection with various manufacturing processes. All those interested in the problems of heating and ventilation will find in Professor Greene's book a very valuable and helpful addition to their reference library.

Charles A. Blatchley.

"Electrical Machine Design." By Alexander Gray. New York: McGraw-Hill Book Company. Cloth, 511 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $4.00.

There are many widely different opinions held by teachers as to what is meant by "electrical machine design" or "design of electrical machinery." To one teacher it means the preparation of drawings and the cultivation of the designing sense. To others it means a course of lectures on electrical machine design. Professor Gray's book was compiled as a course of lectures at McGill University.

The teaching of design has not received the notice that it deserves. As compared to laboratory work it has received practically no attention. Very much has been written about laboratory courses and large sums of money have been invested in laboratory equipment; whereas many schools do not even include in their curriculum electrical design. The writer believes that a course of lectures, such as those given by Professor Gray, supplemented by plenty of calculation and drawing-room work, is as valuable to the correct understanding of theory, as are the taking of data, running of tests and the working out of performance curves on machines that have already been built. It is believed, therefore, that design courses should have a place in the undergraduate's curriculum as well as in the post-graduate's.

In the past, dynamo design has usually been looked upon as an art rather than a science. It is therefore pleasing to read a treatise in which the author points out very clearly that the designer must be ready to apply scientific methods and analysis to his work; and yet one in which the fact has not been lost sight of that he cannot afford to go back to Adam on every design, but must apply "intelligently" empirical formulas, and constants based upon his own or others' experiences.

As a textbook for students the only criticism to be offered is that the book covers too many heterogeneous phases of the subject, rather than a thorough and detailed treatment along a few lines. However, as a reference book, for the experienced designer, this very feature enhances considerably the value of the book, and gives him several suggestive points of view. The book is written in a pleasing, narrative style, is authentic, broad gauge, and unprejudiced in treatment and is therefore an excellent text for a course of lectures on electrical design or a reference book for the experienced designer. As a text used in connection with a lecture course it would give the student an unusually good bird's-eye view of the field; in fact, it seems to be the best book published so far for this purpose.

W. T. Ryan.

"Studies in Terrestrial Magnetism." By C. Chree. London: Macmillan & Company. Cloth, 206 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.60.

This book describes the work of the author in his study of magnetic phenomena and especially in collating the data obtained from the magnetograms at the Kew Observatory, of which he is superintendent. No attempt is made to cover the subject in general, or to deal with the theories which have been advanced to account for the phenomena of terrestrial magnetism. The variations of the elements of the earth's magnetic field are investigated, and special attention given also to magnetic storms, records of a large number of which have been obtained. One chapter is devoted also to the records obtained by the Antarctic expedition of 1901-04. It is pointed out that there are not sufficient data to definitely establish any relation between magnetic perturbations and the occurrence of sun spots. While the book thus deals only with isolated phenomena of terrestrial magnetism, it is written in an interetaining way and will prove of interest not only to the special student, but even to one not already familiar with current knowledge of the subject.

"Ropp's Calculator and Short-Cut Arithmetic." By Christian Ropp. Tenth edition revised. Chicago: C. Ropp & Sons. Best "Moroccoline," 192 pages (5½x9¾ inches). Price $1.25.

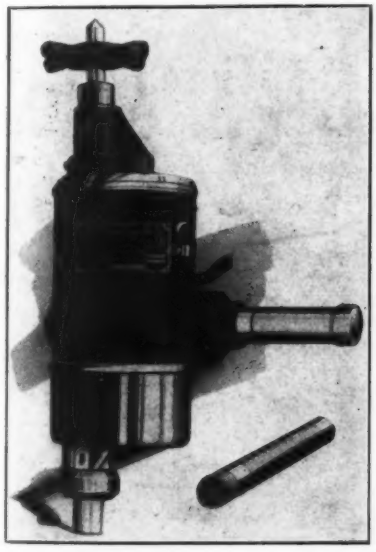
The tenth edition of "Ropp's Calculator" is much larger than the former editions and contains many new and labor-saving tables. It is intended as a reference book for engineers, contractors, mechanics, business men, bankers, miners, and dealers in grain, stock, cotton, etc.; in fact it can be used by anyone requiring short-cut methods in arithmetic. Careful study has been given to the selection of type and whereas every page is a solid form of figures, it is an easy matter to follow the rule for the table given and readily ascertain the desired results. The author has provided tables for almost every conceivable problem that is likely to occur in the office, store, shop, bank, farm or factory.

New Electrical and Mechanical Appliances

New Standard Portable Electric Drills.

The Standard Electric Tool Company, Cincinnati, Ohio, has added to its line the following sizes of high-power direct-current drills: One-quarter, five-sixteenths, three-quarters and seven-eighth-inch. These are in addition to the three-eighths, one-half and five-eighth-inch sizes illustrated and described in these columns at an earlier date.

These tools are provided with ball bearings throughout, the highest grade bearings being used. Extremely rigid construction and high power are special features claimed by the manufacturer. Series motors are employed on



Standard Portable Electric Drill.

all direct-current types, these being insulated and impregnated with a special process. The gears are generated from chrome-nickel steel, and case hardened. They are supported on both ends and incased in grease.

The company has also added to its line of alternating-current drills one-quarter, five-sixteenths, three-eighths, one-half, three-quarters and seven-eighth-inch sizes. The mechanical construction of all tools is extremely simple and rigid and the electrical connections are so simplified that the drills are foolproof. These tools are recommended for the hardest continuous service. All motors have an excess power above rated capacity which eliminates overloads and burnouts. The illustration herewith shows the high-power seven-eighth-inch type fitted with screw feed.

A New General Utility Dry Battery.

The Western Electric Company has recently placed upon the market a new dry battery to be known as the Red Label Blue Bell Battery. It is incased in a bright-red carton, and is designed for intermittent service requiring high efficiency and rapid recuperation. This new battery is a result of careful development work extending over a long period. The service for which the battery is intended made it necessary to investigate with great thoroughness every possible use to which it might be put, so that it could truly be called a general utility battery. The design having been completed and experimental batteries manufactured under the new specifications, exhaustive life tests were made, duplicating service conditions, and the battery "proven in" to the satisfaction of all those concerned in its development from every point of view.

The Red Label Blue Bell battery is of the high-initial-amperage and low-internal-resistance type, having an initial amperage of 25 amperes on short-circuit. These characteristics, together with its powers of rapid recovery after use, ensure its long life and usefulness wherever this general type of battery is required.

A few of the most important uses to which this dry battery is adapted are the following: It may be used for the operation of call bells, annunciators and electrical toys; for operating telephone pole-changers; for railway telephones in furnishing transmitter current on train-dispatching circuits, as selective signaling battery or in operating interrupters. It is also specially fitted for ignition service in general, particularly for all kinds of explosive engines.

Large stocks of fresh batteries will be carried at all times by each of the 20 distributing houses of the Western Electric Company located in the principal cities of the country.

The Racine Table Fan.

A new idea in the solution of the problem of cooling dining rooms and restaurants has been carried out by the development of an electric table fan. The manufacturer of this fan, the Racine Electric Company, Racine, Wis., contends that the ordinary desk or bracket fan gives too direct and strong a breeze for this purpose and that the ceiling type of fan produces a current the reverse from the natural one.

As shown in the accompanying illustration, the Racine table fan has a vertical-shaft motor mounted on a substantial tripod base. About the fan blades is a strong guard which supports a slightly conical deflecting plate, both

Racine Table Fan.

having a nickel finish. This plate has a flange to retain any fruit, fern or similar decorative dish. The main function of the plate, however, is to act as a deflector so as to throw the breeze outward and upward, thus producing a widely spread and pleasing circulation of the air in the natural upward direction.

The fan motor is suitable for either direct-current or alternating-current circuits of standard voltage. It has a three-speed switch, so that the amount of breeze can be regulated to suit the desire of the patrons at each table. This is particularly desirable in a high-class

restaurant or hotel, which makes special efforts to cater to the comfort and tastes of its patrons.

Although specially designed for use on dining tables, these fans have also been found to give great satisfaction on library tables and desks, providing the necessary breeze without disturbing loose papers.

The Curtis Portable Lamp.

A unique type of portable lamp has been developed by Augustus D. Curtis, president of the National X-Ray Reflector Company, of Chicago, Ill. It embodies for the first time the principle of indirect illumination in a portable lamp. Although most distinctively an indirect unit, it can also be used as a direct unit or as a combination semi-indirect unit.

A general view of one of these portables is shown in Fig. 1, which gives some conception of its artistic possibilities. The shade is made either of silk or art glass in a variety of de-

Fig. 1.—Curtis Portable Lamp.

signs; the metal stem and base is also made in various designs and finishes to harmonize with the decorative scheme of the room. Table pedestals and floor pedestals of special design can also be used with these lamps.

The general construction of the lamp unit is shown in Fig. 2, which is a detailed view of the arrangement on top of the stem or pedestal, all of which is ordinarily concealed by the ornamental shade. The main feature is an opaque, conical X-Ray reflector with corrugated-mirror reflecting surface pointing upward, such as used so successfully in the X-Ray system of indirect lighting fixtures. This reflector, shown at *A*, is held in proper relation to the large tungsten lamp *G* by means of the holder and supports *B*. The bottom of the reflector is open and a small part of the light from the large central lamp strikes the white upper surface of the disk *C*, from which it is reflected against the decorative shade, giving it sufficient glow to bring out the beauty of its design. The central lamp *G* is controlled by means of the pull switch *F*.

If it is desired to secure some direct localized light beneath the lamp, pull switch *E* is operated, thus lighting the three small frosted lamps *D* on the edge of the disk. These lamps are no larger than 10-watt tungsten lamps and also give to the shade the illuminated decorative effect of the usual art lamp, but they do not give any general illumination to the room. The large lamp *G*, on the contrary, provides decorative illumination of the lamp and at the same time a charmingly soft indirect illumination to the entire apartment, bringing out the richness of color and detail of tapestries, paintings, furniture and rugs. Since the Curtis portable is designed to light the room from invisible light-sources, it must not be used in conjunction with light from direct fixtures, for exposed lights immediately attract the eye and ruin the effect of the indirect illumination.

The upper part of this portable, which is called the adapter, can be furnished separately. The bottom of the disk at X is adapted for screwing to three-eighths-inch iron pipe and fastened by means of a lock nut. Special table pedestals used with the outfit must be at least 24 inches in height and floor pedestals at least 56 inches in height to keep the upper edge of the reflector *A* above the level of the eye.

These portables are likely to meet with great favor not only in residences, but also in hotels and restaurants.

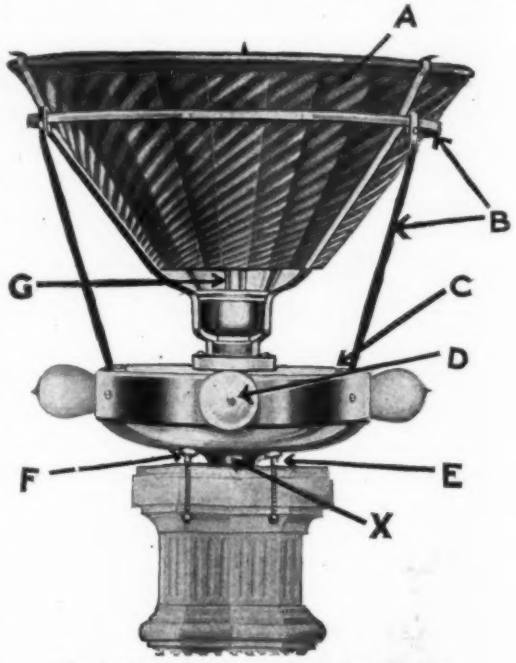


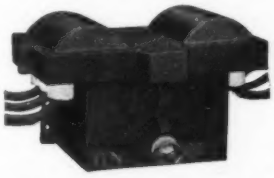
Fig. 2.—View Showing Internal Arrangement.

Fig. 3.—General Effect of the Lamp in Use.

Weatherproof Oil-Break Switches.

It becomes necessary occasionally to open a high-tension electric light or power feeder directly on the overhead or conduit lines while the feeder is heavily loaded, in order to isolate part of the distributing system. This may be caused by the need of segregating a district in which there is a big fire, for cutting out banks of transformers, or for shutting off the power from a circuit on which emergency repairs are to be made, etc. The worst condition of this kind to be met with, of course, is when such an overhead circuit must be opened under heavy load on a wet and stormy night.

To meet even the most severe of



Four-Pole Single-Throw Oil Switch.

these conditions the High Tension Specialty Company, of Newton, Mass., has placed on the market a line of weatherproof oil-break switches that can be mounted directly on the pole or in a manhole. The switch can be opened by a lineman, with perfect safety to himself and to the circuit. It will open any circuit of any power-factor within the rated capacity of the switch and without causing unnecessary disturbance by arcing. These switches are made for circuits ranging from 3,000 to 6,900 volts and for current capacities from 60 to 300 amperes. The 6,900-volt class is made

Oil-Break Series-Arc Cutout.

in 100-ampere capacity only, for either single, double or triple-pole type. Single-throw switches of other rating are made any number of poles up to four. Double-throw switches are made for double-pole use only. The switch mechanism is simple and positive. The casing is strong and completely moistureproof. Although particularly designed for pole or manhole use, these switches have also been found desirable for building entrances and for disconnecting constant-current transformers, synchronous or induction motors, or other apparatus.

A slightly modified form of these switches is designed as an absolute series-arc cutout. When thrown to the "off" position this cutout short-circuits the line toward the source of supply and leaves the loop or section protected by it absolutely dead so that the defective loop may be tested by magneto with perfect safety and without removing any wires from the box. Any number of these cutouts may be placed on a long series circuit (double wire) of arc or incandescent lamps, or both, and an "open" located very quickly by throwing the cutouts off and testing ahead with magneto; this may be done with the circuit alive, so that when the cutout is off the lamps behind it will at once start up.

Another valuable feature of these oil-break series cutouts is that the break in oil permits of flashing in a loop which may show "open" by magneto due to broken incandescent lamps as is frequently the case since the paper-film cutout does not operate when the current is off at the time the lamp is broken. It is oftentimes impossible to flash in a loop under such conditions with the ordinary air-break cutout, due to the arcing across the contacts. The fact that such loops may be readily flashed into circuit oftentimes saves a great deal of time in restoring service. This cutout is suitable for use on 8,000-volt circuits.

Schwarze Alternating-Current Bell and Buzzer.

For many years the Schwarze Electric Company, of Adrian, Mich., has been specializing in the manufacture of powerful electric bells for all purposes where a loud-sounding bell is needed. Among its patrons are scores of the leading steam railroad and electric railway companies in this country who have found the Schwarze crossing, car, and power-house bells to be very reliable. The company has also made a high reputation for itself in the making of fire, police and burglar-alarm bells, bells for telephone extension, factories, mines, etc. From this extensive experience there have been evolved from time to time, new types of electric bells suited particularly to some special service. Among the company's most recent developments are the new Cyclone single-gong magneto bell and the magneto buzzer.

The Cyclone bell is especially designed for use on alternating-current 60 cycles and overcomes the objections heretofore raised to magneto bells that they were not loud enough. This has been the result of the peculiar blunt and rapid stroke required in an ordinary magneto bell. The construction of this bell is entirely different from that of any other bell of this kind. It has no bell hammer or bell-hammer clapper, but is simply operated by a plunger. The plunger stands free between the gong and the armature. This is done for the purpose of reducing the moving weight which has always been a detriment to a magneto bell when it is operated on 60-cycle circuits. The weight in the armature is of such proportion that it is perfectly able to keep in step with the changes of the alternations, and give the bell the hardest stroke which can be se-

Cyclone Magneto Bell.

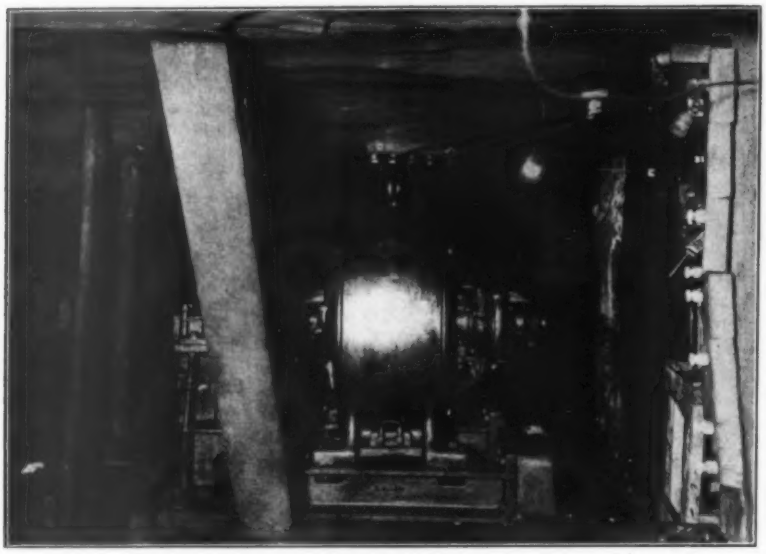
cured. The Cyclone bell is said to have the full ringing qualities of a vibrating bell. The gong used is made of hot-pressed steel thoroughly nickel-plated. Gongs are made from six to ten inches in diameter. The casing is of rugged and yet pleasing design. The bell can be operated from a bell-ringing transformer or in series with a lamp resistance. If desired, it can be wound so it may be connected direct to standard-voltage circuits.

Alternating-Current Buzzer.

Attempts to operate the common direct-current buzzer on alternating-current circuits are usually only partly successful. Recognizing this fact, the Schwarze Electric Company has produced a new magneto buzzer that can be used on any alternating-current circuit. It is of the same general design as the company's magneto bells, and like them operates very effectively. The sealed construction makes these buzzers entirely dustproof and weatherproof. The coils are wound to various resistances between 80 and 2,500 ohms.

Self-Starting Direct-Current Motors for Driving Mine Pumps and Fans.

The electric motor has proved so thoroughly satisfactory for driving mine pumps and fans that it seems almost impossible to improve it. It can be placed wherever a pump or a fan can be located; a couple of wires supply it with the power it needs; and when running it requires no attention whatever beyond occasional inspection and oiling. In fact, motors have proved themselves so useful and economical that they are rapidly displacing all other forms of power for fan and pump service wherever electricity is available.



Self-Starting Direct-Current Mine Motor.

An improvement has, however, been recently developed which greatly increases the value of motors for mine work. This improvement consists in making the direct-current motor self-starting.

Heretofore, while it has been possible under some conditions to start them from the power house, most motors driving mine pumps and fans had to be started by hand. Hence if the power was off temporarily for any reason the motors stopped, necessitating sending an attendant to each station to start them again.

With the new self-starting direct-current motors this inconvenience is done away with. When the power fails, the motors stop, it is true, but as soon as the power comes on again, the motors start automatically and settle down to work as though nothing had happened. Moreover, starting boxes are rendered unnecessary, and the wiring is of the simplest possible character. An occasional visit of inspection is now all that the motors require. Otherwise they can be left entirely to themselves.

These motors have been thoroughly tried out in practical service and their uses are commending them highly, as is shown by the number of repeat orders the manufacturers are obtaining.

The electrical characteristics of the self-starting motor differ but little from those of the usual type, the only alteration being in the use of a heavier compound winding, which reduces the flow of current when starting up.

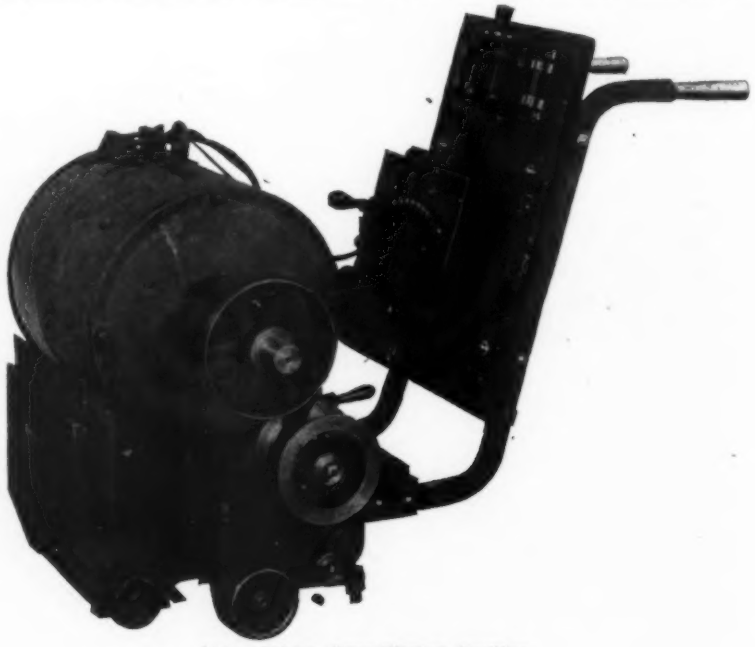
These self-starting motors are made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in ratings up to 20 horsepower.

Electric Drive of Portable Deck or Floor-Planing Machine.

The electric drive of the deck and floor-planing machine illustrated herewith presents some novel features, and a brief description of both motor and machine should be of value to those interested in portable electrical applications.

The motor must be totally inclosed to obviate contact with its moving parts of the shavings and dust thrown by the knives; at the same time it must be light in weight and of small bulk. The minimized weight is especially noteworthy owing to the fact that the whole machine is portable, being modeled somewhat upon the style of a hand truck, wheeled and operated by a single operator who controls the movements of the knives by two guiding handles, and the power through the switch and rheostat which are mounted upon a panelboard shown in the illustration and within easy reach of the hand. The motor must also run constantly at high speed.

The drive shown was evolved by the Diehl Manufacturing Company, of Elizabeth, N. J., and consists of a K-6, steel-frame, shunt-wound, commutating-pole motor, operating at 2,200 revolutions per minute. Owing to its hardy construction this motor is able to withstand successfully the sudden and severe overloads imposed upon it, as the knives constantly encounter unforseen hard spots and knots for which no provision can be made.



Motor-Driven Floor-Planing Machine.

The motor is connected to the cutting cylinder containing the knives by belt and idler. The cylindrical frame

of the motor renders it especially adaptable to this service, coupled with the fact that moving parts subject to wear are standard and interchangeable. This motor is totally inclosed with solid end bonnets and a steel-strap handhole cover which fits snugly about the frame and is secured by the turn of two wing nuts giving ready access to brushes and commutator, if desired. Its weight is approximately 575 pounds.

The whole machine is mounted on rollers of hardened steel, the back set of rollers being so arranged that they can be lowered for more or less depth of cut, and also when drawing the machine backward for starting a new cut, it will automatically raise the knives clear of the floor.

Emerson Alternating-Current and Direct-Current Fan Motors for 1913.

For the season of 1913 few changes have been made in the line of fans manufactured by the Emerson Electric Manufacturing Company, of St. Louis, Mo. However, the Trojan line, formerly made by the company, has been discontinued, and manufacturing and

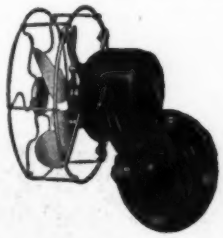
Emerson Alternating-Current Desk Fan.

sales efforts concentrated on the higher-grade Emerson apparatus. This policy has resulted in a larger stock of the types listed for 1913, a simpler line for the jobber and dealer to handle, and has permitted substantial reductions in the prices of Emerson desk and ceiling fans for alternating-current circuits.

Emerson alternating-current desk fans are offered in 8, 12 and 16-inch sizes, oscillators in 12 and 16-inch sizes, and special slow-speed quiet residence-type motors with 12-inch six-blade fans, delivering a large volume of air with minimum noise. These residence types are made in both swivel-trunnion and oscillating styles.

The foregoing Emerson fans are all provided with induction motors without brushes or commutator. In the present styles all moving contacts have been eliminated and excellent speed regulation is secured. These fans have the well known Parker patented blade, which has been a feature of Emerson fans for many years, and the convertible base permitting change to the bracket position without extra parts.

These motors are all equipped with the distinctive Emerson hardened-steel shaft and oiltight dustproof bearing, which has been employed by this manufacturer for more than a decade. The advantages of this style of bearing



Alternating-Current Bracket Fan.

are known and appreciated by a large number of purchasers. Its wearing qualities and freedom from oil-throwing have made it popular.

The Emerson oscillators are mechanically operated types, with four ranges of oscillation secured readily by a thumb nut at the rear of the motor. The same style of oscillating device has been used by the Emerson Company for three years past with complete success. All wearing parts are readily renewable in a few minutes with a common screwdriver.

Emerson induction ceiling fans are offered in plain and ornamental four-blade types, with a two-blade ornamental type in addition for purchasers desiring a more moderate breeze. These are induction fans without moving contacts of any kind, and run on ball bearing immersed in oil. These fans are well known to the trade, and are offered

Emerson Oscillator.

at especially attractive prices this season. Column fans can be furnished to special order in the same styles as ceiling fans.

For direct-current circuits the Emerson Company offers 8, 12 and 16-inch swivel-trunnion fans, and 12 and 16-inch oscillators, with many of the familiar features of Emerson alternating-current fans, including the Parker blades, the convertible base, and the same style oscillating mechanism, with renewable wearing parts. The 12 and 16-inch fans for direct current are fully inclosed motors, with removable shutters, three-eighth-inch square carbon brushes and large commutators of very high-grade material and careful workmanship. The fans throughout are

Ceiling Fan and Electrolier.

thoroughly representative of the standards of design and manufacture used in all of the Emerson alternating-current fans.

Both the Emerson alternating-current and direct-current desk fan motors are offered this year mounted in substantial supporting rings for use as ventilating fan motors, in 12 and 16-inch sizes. These ventilating motors have separate three-speed regulating

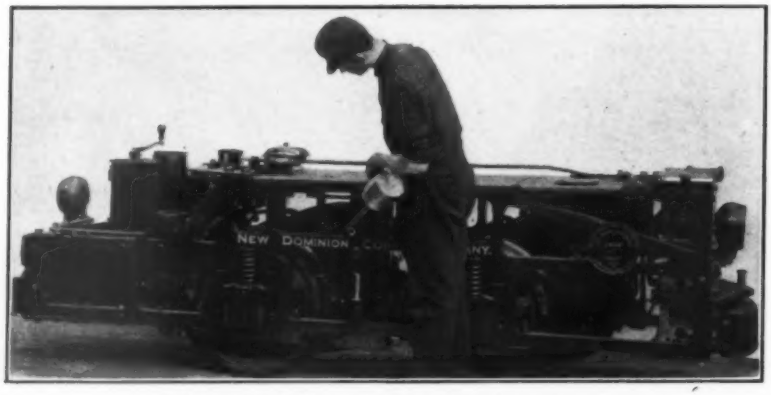
Ventilating Fan Outfit.

switches mounted on porcelain bases, and are offered at very attractive prices.

A feature of the manufacturer's selling plans for 1913 is a five-year registered factory guarantee which the retailer is enabled to offer the user in behalf of the Emerson Electric Manufacturing Company.

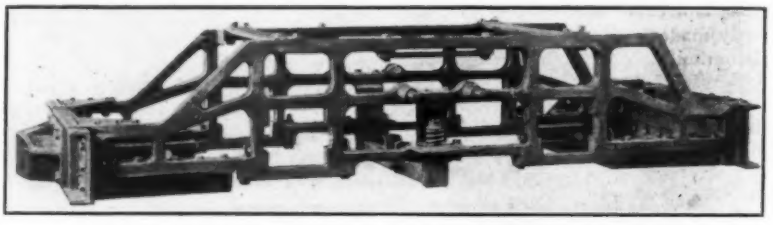
New Type Baldwin-Westinghouse Electric Mine Locomotive.

The accompanying illustrations show a new type of mine locomotive which has recently been placed on the market by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. Its notable features are the open cast-steel bar frame and the specially designed commutating-pole motors.



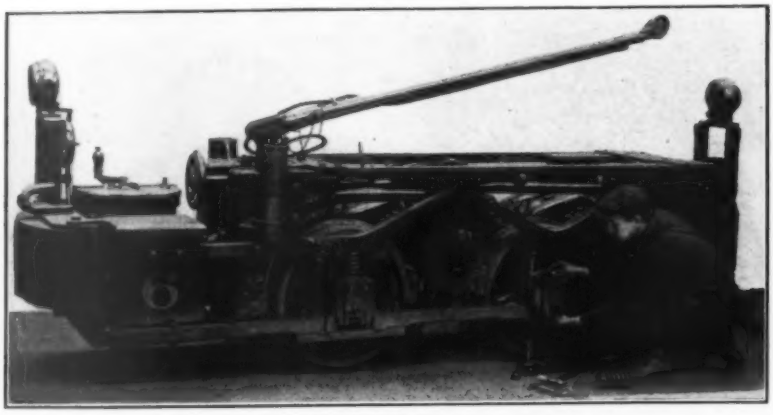
Baldwin-Westinghouse Electric Mine Locomotive.

This type of locomotive is distinguished for its accessibility, simplicity, durability and strength. It is claimed that it will operate satisfactorily under the worst conditions with minimum attention and maintenance expense. The frame is designed to give maximum strength and to allow ready access to all parts so that the locomotive can be inspected or overhauled, when necessary, in the least possible time. The construction is the same as that used on heavy Baldwin steam freight engines.



Typical Cast-Steel Bar-Type Frame for These Locomotives.

An attractive feature introduced on locomotives with outside frames is the Vauclain removable gib. To remove a journal box with this gib, it is only necessary to drop the binder and take the weight off the journal box. The journal box may then be slipped out from the side, as shown. On locomotives with inside frames, the journal-box collars are arranged to be easily dropped out for repacking. If it is desired to take out a set of wheels and axle, this may be done without disturbing the motor suspension or connections by simply blocking the motors in place and removing the binders. The wheels may then be dropped.



Removing Journal Box with Vauclain Gib.

The open frame gives much better ventilation to the motors and resistances than that obtained by armor-plate frame construction. The motors, brake rigging, brake shoes and sand boxes are easily accessible. The upper parts of the motors and armature-bearing housings can be removed without disturbing the suspension, so that each part of the motor is readily exposed for inspection. To remove the grid resistors the only work necessary is to take off the locomotive covers and loosen the bolts and terminals that hold the resistor frames in place.

The motors used in this locomotive have decided advantages over other types, of which their excellent commutation, due to the use of commutating poles, is of first importance because it increases reliability of operation and cuts down the cost of maintenance. With good commutation, the commutator and brushes require very little attention and brush renewals are seldom necessary. The insulation of armature and field coils remains in good condition for a much longer time than on other types because of the absence of copper and carbon dust.

The frames of the motors are made of cast steel and are split diagonally. The axle bearings and suspension nose are on the lower half of the frame, so that the upper half, the armature, and bearing housings can be removed without disturbing the suspension or axle brackets. The armature and axle bearings are of bronze and are lubricated by both oil and waste. The armature coils are form wound and are made moistureproof by means of an impregnating compound. The field coils are impregnated and protected from vibration by heavy cushion springs placed between them and the motor frame. The armature core is mounted on a spider to which it is keyed, making it possible to remove the shaft without disturbing the windings, and also reinforcing the shaft against bending. Large openings are provided in the spider and through the core to give sufficient ventilation.

Commutating-Pole Motor for Mine Locomotive.

McMeen & Miller, Incorporated.

The well known engineering firm of McMeen & Miller, which for the past 10 years has existed as a partnership between Samuel G. McMeen and Kempster B. Miller, has been incorporated under the same name. The personnel of the new firm includes Mr. McMeen and Mr. Miller, the former partners, and as a new member, Leigh S. Keith, who for a number of years has been connected with the firm in the capacity of managing engineer.

The incorporating of this firm comes as the result of its constantly widening field operations. The old partnership was established, primarily, to conduct a general telephone engineering and patent expert practice. Mr. McMeen and Mr. Miller were the first engineers to establish themselves in a general telephone engineering business, detached from all manufacturing and operating concerns. The scope of the concern has rapidly widened, so that the greater bulk of the work of the firm for a number of years has been in the line of consultation, design, construction and management in connection with properties in the railway, light and power fields, and in investigations of public service corporations for private and municipal interests.

Mr. McMeen, who is the senior member and vice-president of the new firm, is well known as one of the pioneer telephone men of the country, having served the Central Union Telephone Company in all capacities from operator to chief engineer. Later he had wide manufacturing experience with the Western Electric Company, and since entering into partnership with Mr. Miller, has become well known as a designer and constructor and as an executive of public service corporations. Among the more recent notable work done by Mr. McMeen, might be mentioned the engineering, construction and subsequent executive management of the San Francisco Home Telephone Company, and his services as president of the Mount Hood Railway & Power Company, of Portland, Oregon, during the later stages of its plant construction and previous to its consolidation with the Portland Railway, Light & Power Company.

He is at present located at Columbus, Ohio, where he is devoting practically his entire attention to the affairs of E. W. Clark & Company, of Philadelphia. He is president of the Columbus Railway & Light Company, one of the Clark properties, and has the executive management of all of the allied electric properties in Columbus. He also serves in an advisory capacity in the Clark properties throughout the country.

Mr. Miller, who is president of the new firm, is perhaps best known to the world as the author of "American Telephone Practice," for many years considered the standard treatise on telephony the world over. Mr. Miller, after graduating from Cornell, served a short apprenticeship in the lighting and power departments of the Thomson-Houston and Westinghouse factories, then entered the telephone manufacturing field in Chicago, and for many years was indentified, as engineer and manager, with the Kellogg Switchboard & Supply Company. Since entering the field of general consulting engineering, his talents have been directed to a wide variety of works, some of them of notable importance. He has devoted much of his attention to special investigations of public utilities, both from the engineering and financial standpoints. He is general manager of the Central Oregon Power Company and is at present devoting much attention to the development of hydroelectric projects on the Deschutes River, in Oregon. He is also acting as consulting engineer on special problems for a number of electric railway, light and power companies, particularly specializing, in this connection, on the subject of electrolysis of underground structures.

Leigh S. Keith, the secretary-treasurer of the new firm, is a graduate of Massachusetts Institute of Technology. For a number of years after graduating he was employed in the engineering department of the New York Telephone Company, the later years of this service being spent in the making of special investigations directly under the chief engineer. About four years ago he entered the employ of McMeen & Miller, and has been engaged in a wide variety of engineering work, particularly relating to public-service investigations of light, power and telephone properties, and various special problems in the field of electric railway work, such as the location of substations, the design of feeder systems and the prevention of electrolysis. For the past three years he has been managing engineer of the firm, so that in becoming one of the principals, the change involved is more of name than of function.

The organization of the company has been increased so as to include a full corps of experienced engineers fitted in every way to handle properly, not only the general work of a consulting engineering business, but, also the more specialized details of economical and efficient design and construction of steam or hydroelectric stations, high-tension transmission lines and overhead and underground distribution systems.

"Electric Service," a Useful Monthly for Central Stations.

"Electric Service" is the name of a new monthly bulletin, now available, that is exactly suited to the local requirements of central stations. It is a high-grade 16-page publication, written by magazine and newspaper writers of repute, who know how to produce that quality of readability which is so essential to publications of this kind. However, under the careful supervision of experts in commercial electricity the electrical mission of the bulletin—its mission of maximum commercial worth to central stations is never lost sight of.

"Electric Service" is designed to be sold with any company's name on the cover and in any lot desired. Three pages of advertisements, adaptable to local conditions, will feature each issue. The bulletin will be freely and beautifully illustrated each month by artists whose work is seen in the best magazines.

The first issue of "Electric Service" has a number of bright, entertaining articles on "electric" luncheons, fixtures, street lighting, modern housekeeping, the merchant's employment of current, and other electrical topics, the idea being to cover the field in comprehensive and timely fashion. The commercial purpose of "Electric Service" is not made too evident, but just evident enough. The bulletin is easy to distribute, since it fits into the ordinary business envelope, and is reasonable in price. The publisher is the Rae Company, 17 Madison Avenue, New York City.

Annual Salesmen's Convention of H. W. Johns-Manville Company.

Following a long established custom, the 600 or more salesmen, as well as the department managers, of the H. W. Johns-Manville Company, assembled in annual conventions on various dates from January 2 to February 8, at Milwaukee, Boston, New York, Philadelphia, Pittsburgh, Cleveland, Chicago, St. Louis, New Orleans, San Francisco and Toronto, to learn more about the products which they sell.

One by one about 300 products of this concern were taken up and their advantages over competitive products pointed out to the salesmen by specialists in each line.

A week's time was devoted to each of these conventions, with a banquet at the close as a fitting ending.

New Mexico's production of copper increased by 4,057,040 pounds in 1912 as compared with 1911.

An electric clock has been in continuous operation since 1870 at Camp Hill, Pa.

Latest Approved Fittings

ATTACHMENT PLUGS, Fuseless.—General Electric Company, Schenectady, N. Y.

Three-point, 660 watts, 250 volts, catalog No. GE451, for use with electric heaters.

Approved January 29, 1913.

CORRUGATED MICARTA CLEATS.—Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

A molded composition cleat made in strips for securing low-voltage instruments and control-circuit wiring on the backs of switchboards.

Approved January 29, 1913.

CONDUIT BOXES.—J. Gordon Knight Electric Company, 123 Liberty Street, New York, N. Y.

"Knight Type C." pressed-steel conduit box for armored cable and one-half-inch conduits in concrete. This box has a back plate which can be removed to permit ready access to the interior of the box while cables or conduits are being connected to it by wiremen.

Approved January 29, 1913.

FIXTURE WIRE.—Atlantic Insulated Wire & Cable Company, 120 Liberty Street, New York, N. Y.

Marking: Green and black threads crossing in braid.

Standard, National Electrical Code, 1911 edition.

Approved January 21, 1913.

MUSICAL INSTRUMENTS.—Operators Piano Company, 255 West Huron Street, Chicago, Ill.

A motor-operated, electrically lighted piano, with a special design of coin switch.

Approved January 13, 1913.

PANELBOARDS.— Wheeler-Green Electric Company, Rochester, N. Y.

Approved December 31, 1912.

PICTURE MACHINES AND APPLIANCES. — The Nicholas Power Company, 90 Gold Street, New York, N. Y.

"Power's Cameragraph," No. 6A, two types; one for hand operation, the other driven by one of the special motors mentioned below, supplied by The Nicholas Power Company and expressly approved for this purpose:

Direct-current motors: Colonial Fan & Motor Company, one-eighth horsepower, 120 volts; Engineering Electrical Manufacturing Company, one-twelfth horsepower, 110 volts.

Alternating-current motor: Engineering Electrical Manufacturing Company, Type A, one-fifteenth horsepower, 110 volts.

Approved December 18, 1912.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

PICTURE MACHINES AND APPLIANCES.—The Precision Machine Company, 317 East Thirty-fourth Street, New York, N. Y.

"Simplex" Projector." Two types; one for hand operation, the other driven by a special motor mentioned below, supplied by the Precision Machine Company, and expressly approved for this purpose.

Direct-current motor; Peerless Electric Company, one-tenth horsepower, 115 volts.

Approved January 22, 1913.

RECEPTACLES, Standard.—Arrow Electric Company, Hartford, Conn.

Rosette Receptacles mounted on link fuse rosette bases, 2 amperes, 125 volts.

Brass Shell.

Cleat, Catalog Nos. "Twenty-point" 68227, 68232, 68238; "Arrow Forty" 8052, 8053, 8526.

Concealed, Catalog Nos. "Twenty-Point" 68226, 68231, 68237; "Arrow Forty" 8050, 8051, 8525.

Also all the above types with shade-holders attached; key type with composition or insulated metal key.

Approved December 21, 1912.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

"Bryant" Porcelain Shell.

Keyless, 660 watts, 250 volts.

Cleat, Catalog Nos. 4008, 4013, 4038 (for temporary decorative festoon work), 9402, 9403, 11221, 28795, 50715, 58300, 58301 and 58949.

Concealed, Catalog Nos. 4000, 4001, 4002, 4010, 50744; also 9447, fusible, 2 amperes, 125 volts.

Molding, Catalog Nos. 4012, 4024, 4025, 4026, 42453, 58302, and 58950.

Conduit Box, Catalog Nos. 4003, 4033, 4046, 4049, 4064, 9397, 9514, 40507, 40,-537, 59107, 62355, 62356 and 62357.

Sign Catalog Nos. 1700, 4003, 4023, 4035, when leads are properly soldered to terminal plates and sealed with an approved insulating compound which does not melt below 150 degrees Fahrenheit, 4036, 4063, 40488, 59108, 61777, 61988; also 4014 ("Ruby" 102717) and 4057, when installed so that both the porcelain base and metal rings are held by means of solder so that they cannot turn in the sign face.

Approved January 20, 1913.

RHEOSTATS. — Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"Star-Delta" switch 10-20 horsepower.

Approved January 13, 1913.

RHEOSTATS.—Electric Controller & Manufacturing Company, Cleveland O.

"E. C. & M." motor-starting rheostats for direct-current motors; one-fourth to 50 horsepower, 110, 220 and 550 volts.

Approved December 18, 1912.

ROSETTES, Fuseless.—The Arrow Electric Company, Hartford, Conn.

Concealed, catalog No. 298.

Conduit Box, catalog No. 369.

Approved January 7, 1913.

ROSETTES, Link Fuse. — The Arrow Electric Company, Hartford, Conn.

"Arrow E," 2 amperes, 125 volts.

Cleat, catalog Nos. 950, "Midget" 1501.

Concealed, catalog Nos. 871, "Midget" 1502.

Condut Box, catalog No. "Midget" 368.

Approved January 7, 1913.

SOCKETS, Standard. — Benjamin Electric Manufacturing Company, 120-128 South Sangamon Street, Chicago, Ill.

Porcelain-shell pendent sockets with cord grip, 660 watts, 250 volts; catalog No. 240.

Approved January 18, 1913.

SWITCHES, Pushbutton, Flush.—The Bryant Electric Company, Bridgeport, Conn.

Catalog No. 413, consisting of a combined pushbutton flush switch and pilot lamp, mounted on a porcelain base and provided with a face plate.

Approved January 22, 1913.

TRANSFORMERS. — The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

For Thomas A. Edison, Incorporated, Orange, N. J.

Edison Projecting Kinetoscope Economy Transformer; 110-volt primary, 40-ampere secondary.

Approved January 22, 1913.

WIRES, Slow-Burning.—American Insulated Wire & Cable Company, Twenty-first, Sangamon and Morgan Streets, Chicago, Ill.

Marker: One red and one green thread woven in the intermediate layer of braid.

Approved January 29, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

PEARSALL, TEX.—The City Council has decided to enlarge the street lighting system here. D.

MILWAUKEE, WIS.—This city is discussing the idea of starting a municipal street lighting plant.

UNION CITY, TENN.—A "Great White Way" is to be installed in the principal business districts.

CHICOPEE, MASS.—The aldermen of this place have granted locations for 400 poles to the Amherst Power Company. B.

CANAL FULTON, O.—At a recent meeting of the Council the question of a new plan for lighting the town was discussed.

TRENTON JUNCTION, N. J.—The Borough authorities are considering the installation of an electric street-lighting system. A.

JACKSON, MISS.—A boulevard system is to be purchased by the Jackson Railway & Light Company. John Abbott is manager. G.

PORT MURRAY, N. J.—It is reported that an electric light plant is to be installed at the Port Murray terra cotta plant.

EL PASO, TEX.—The 30-year franchise, formerly held by H. C. Bosworth, has been transferred to the El Paso Gas & Electric Company.

ST. FRANCISVILLE, LA. — The management of the city light and water plant has under consideration plant improvements to cost about $6,000.

LOS ANGELES, CAL.—Bids will be received up to March 3 for installing the necessary equipment for lighting certain streets in the Lawndale lighting district.

WILKESBARRE, PA.—A franchise to light the township of Plains has been granted to the Pennsylvania, New York & New Jersey Power Company.

PENDLETON, ORE.—A water-power site and filing right have been purchased by this city, and the construction of a municipal power and light plant is considered. O.

COVINGTON, KY.—Licking River Power Company has been incorporated with a capital stock of $5,000 by Francis M. Butler, James B. Cox and S. D. Rouse.

SPOKANE, WASH.—The Washington Water Power Company has outlined plans for the construction of an electric power line between Spokane, Chewelch and Republic.

ELKSVILLE, ILL.—This village has granted a 25-year franchise to C. T. Bass & Son to erect poles and wires and furnish electricity for light and power purposes.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has been granted a 50-year franchise for a power line over county roads near Naches, and through that town.

KENTON, TENN.—This city will receive bids March 11 on the erection and equipment of an electric light plant. R. C. Huston & Company, Memphis, Tenn., have the plans and specifications. G.

LOUISVILLE, KY. — Lighting equipment for a boulevard system with underground wiring is soon to be purchased by the Contract Committee of the Board of Park Commissioners.

LOUISVILLE, KY.—The American Creosoting Company is in the market for several motors to be connected with pumps, orders for which were recently placed. Address the purchasing agent.

PORT EDWARDS, WIS.—The Nekoosa Edwards Light & Power Company has been incorporated with a capital stock of $5,000 by L. M. Alexander, C. A. Jasperson and A. V. Marvin.

ALAMAGORDA, N. M.—George Carl and associates will install an electric light and power plant here, and construct power transmission lines to irrigation pumping plants in this section. D.

SALEM, ORE.—The North Pacific Gas & Electric Company has been incorporated with a capital stock of $1,000,000, by C. J. Franklin, F. L. Shull, H. E. Lounsbury, W. W. Seymour and F. C. Brewer.

WASHINGTON, D. C.—George Bowers, U. S. Commissioner of Fisheries, will be in the market shortly for two 60-horsepower motors for installation at the fish hatchery to be established in Louisville, Ky. G.

EDEN, WIS.—Eden Electric Light Company has filed articles of incorporation with a capital stock of $5,000. John O'Brien, K. L. O'Brien and Frank Sieloff are named as the incorporators.

PORTLAND, ORE.—The Council has granted a franchise to the Portland Railway, Light & Power Company to construct lines on numerous streets, of a total length of more than 18 miles.

ARLINGTON, TENN.—This city has prepared plans and specifications for the erection and equipment of an electric light plant of moderate size. R. C. Huston & Company, Memphis, Tenn., are the engineers. G.

TRENTON, N. J.—The Pennsylvania Railroad Company is planning for the installation of ornamental lighting fixtures with incandescent lamps on the new Prospect Street bridge now in course of erection. A.

LITTLE ROCK, ARK.—The Ashdown Light & Power Company has been incorporated with a capital stock of $10,000. The incorporators are H. B. Sanderson, A. D. DuLaney, H. L. Toland and R. B. Bryant.

WELEETKA, OKLA.—Oklahoma Power Company has been incorporated with a capital stock of $5,000 by J. B. Swan, and John Smith, Henryetta; Lake Moore, B. O. Sims, Weleetka; and W. D. Ford, Muskogee.

CLAYTON, IND.—The Citizens of this town have voted unanimously to install an electric system. The Terre Haute, Indianapolis Eastern Interurban Road will furnish the current for lighting and power purposes. S.

HASTINGS, NEB.—An order for a large extension of street lighting has been given by the City Council. The Light Commissioner has been instructed to purchase 60 arc lamps to be placed in outlying parts of the city.

TRENTON, N. J.—The New Jersey State Hospital for the Insane is planning for the erection of a new central power plant to cost about $60,000. An appropriation of such amount has been requested of the State authorities.

TOMS RIVER, N. J.—The Central Jersey Power Company has been incorporated with a capital stock of $125,000 to operate an electric power plant. S. R. Applegate, Eli R. Yoder and George C. Van Hise are the incorporators.

TWIN FALLS, IDAHO.—The creation of an improvement district and the installation of cluster lights from City Park to the Short Line Depot and along three blocks on Main Street, has been decided upon by the City Council. O.

OCEAN CITY, MD.—The Mayor and the City Council have under consideration a municipal lighting and power plant and are consulting different engineers with a view to having the plant in operation for the coming season.

LONDON, ONT.—It has been announced by Hon. Adam Beck that three new hydroelectric lines will be built out of this city in the spring. These will serve the agricultural districts and a number of towns and villages.

LOUISVILLE, KY.—Webster Gazlay, Board of Trade Building, will have plans and specifications for the electrical equipment to be installed in the new power plant of the Seelbach Hotel Company of that city ready by March 1. G.

MILTON, ORE.—The Pacific Light & Power Company will expend $10,000 on the enlargement and improvement of a sub-station here. Transformers and other machinery to be installed will increase the capacity of the station from 500 to 1,000 horsepower. O.

GLOBE, ARIZ.—The United States Government surveyors are locating the route for an electric power transmission line to run from the hydroelectric plant at the Roosevelt dam to Superior. The proposed line will furnish power for a number of mines and other industries. D.

BALTIMORE, MD.—Lighting Superintendent McCuen has announced that he is planning an ornamental system of lighting for the streets surrounding the Polytechnic Institute buildings on North Avenue. An extension of the ornamental lighting system on Charles Street is being considered.

MONTPELIER, IND.—The Montpelier Utilities Company has been incorporated with a capital stock of $50,000. The company proposes to build, equip and operate a plant for the sale of electric current to Montpelier and the surrounding community. J. P. Boyd, G. A. Bracken and R. J. Sidney, are the directors. S.

SALEM, ORE.—The Interior Electric Light & Power Company has filed articles of incorporation and has purchased water-power rights on the Walla Walla River. The company expects to develop 4,000 horsepower. The incorporators are Howard Evans, W. B. Brooke, W. T. Parrish, L. H. Reineman and J. A. Bradley.

PORTLAND, ORE.—An ordinance already drafted and to be introduced in the City Council, calls for a 25-year franchise for a heating plant and distributing system for the Northwestern Electric Company, which proposes to furnish steam heat to nearly all the office buildings, hotels and department stores in the business district. O.

TRENTON, N. J.—In the budget for city work for 1913, approved by the Board of City Commissioners, the Department of Parks and Public Property has been granted a net increase of $9,500 for the installation of new street lamps and other park improvements. The fire department has also been granted an allowance for the purchase of a pulmoter. A.

BALTIMORE, MD.—The farmers of Perry Hall and vicinity have under consideration establishing an electric power plant for neighborhood service. Two fine water-power sites are available and it is believed the plan can be put through at a moderate cost. The plant would furnish power for grinding, sawing, threshing, and many other activities of farmers.

HAMBURG, PA.—Notice has been given that four People's Electric Companies will file articles of incorporation on March 7, each with a capital stock of $5,000. The incorporators are named as David S. Wolf, Grant E. Alleman and Allen A. Baver, all of Shoemakersville, the latter being treasurer of the Hamburg Gas & Electric Company, whose lines these new companies propose to extend.

ASHTON, IDAHO.—It is understood that about June 1 work on a dam 50 feet high and a power plant capable of developing 5,000 horsepower, will be started three miles west of Ashton on the Narrows. N. M. Holm, civil engineer of Shelley, is the promoter and will be the constructing engineer. He already has secured the permit of the state and has purchased right of way on both sides of the Snake River. The company has been organized for $200,000.

CHICKASHA, OKLA.—The City Council has adopted a resolution approving the consolidation of the light and power plant operated by the Chickasha Gas & Electric Company and the Chickasha Light, Heat & Power Company. The consolidated plant will be operated under the franchise of the Chickasha Gas & Electric Company. It has been stated that one company could afford to enlarge its plant sufficiently to handle all of the business of the city in a satisfactory manner. P.

SEATTLE, WASH.—Jacob Furth, financier, and head of the Traction properties in Seattle, is authority for the statement that the Stone & Webster Engineering Corporation will build a $6,000,000 power plant on the upper Skagit River, near Marblemouth. The proposed generating plant will have a capacity of 200,000 horsepower, which will probably be enough to supply current for all the electric roads, and to supply the towns of the Northwest with commercial electricity. The plant will be the largest in the Northwest.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

JAMESBURG, N. J.—The Jamesburg Fire Department is considering plans for the installation of a modern fire-alarm system. A.

EAU CLAIRE, WIS.—The Rock Falls & Meridean Telephone Company plans to build a trunk line to Eau Claire in the spring.

LITTLE ROCK, ARK.—The White River Telephone Company has been incorporated with a capital stock of $12,000 by T. J. Raney, David A. Gates and M. J. Manning.

HURDSFIELD, N. D.—Crystal Lake Telephone Company has been incorporated with a capital stock of $10,000 by Fred Dietrich, T. J. Lacock and C. Knutson, all of this city.

GLOUCESTER CITY, N. J.—The Delaware & Atlantic Telegraph & Telephone Company will extend its underground conduit system beyond the present terminus at Bergen Street.

NON, OKLA.—The Reliable Telephone Company of Non has been incorporated with a capital stock of $5,000 by S. J. Ingram, S. H. Hamilton and H. D. Binns, all of this place.

IRON RIVER, WIS.—C. H. Townsend and Joseph Schachte have been appointed a committee to perfect the organization of a company which will build a telephone line from Iron River along the Port Wing-Iron River road.

AVILLA, IND.—Avilla Mutual Telephone Company has filed articles of incorporation with a capital stock of $5,000 to operate a telephone line in this city. Thomas Kelham is president and Frank Kelham, secretary of the company.

CHICAGO, ILL.—The United Telephone & Telegraph Company has been organized under the laws of Maine with a nominal capital stock of $10,000. The directors named in the incorporation papers are D. J. Schuyler, Charles Weinfeld and Wilson P. Dysart, all of Chicago.

AURORA, ORE.—Telephone users of this section will organize a mutual telephone company to serve the section from Canby, on the north, to Woodburn, on the south, and from Molala to St. Paul, Ore. Articles of incorporation have been drafted, and a committee has been appointed to investigate the cost of the proposed system. N. C. Westcott, Aurora, Ore., Dr. Henry Goulet, of Woodburn, Ore., J. P. Feller, of Donald, Ore., are interested in the movement. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ST. LOUIS, MO.—The East St. Louis & Suburban Electric Railway is planning to build a loop to provide a continuous track for East Side passengers.

FT. BRANCH, IND.—The Evansville Utilities Company is preparing to ask for bids for the construction of a branch traction line from Robinsonville Crossing to Owensville. S.

PORTLAND, ORE.—Work of constructing the extension of the Hawthorn Avenue car line through South Mt. Tabor will be started by the middle of March, by the Portland Railway, Light & Power Co. O.

PERTH AMBOY, N. J.—The Public Service Electric Company will double-track and improve its system on Smith Street and State Street. Permission for the work from the city executive committee has been requested. A.

ASOTIN, WASH.—Providing the application of F. L. Sturm and associates for a franchise for the proposed electric line between Clarkston, Idaho, and this city, is granted, work of construction will begin at once. O.

TOLEDO, O.—Plans have practically been completed for the extension of the Toledo & Indiana electric line ten miles beyond its present western terminus at Bryan to Montpelier. Work will be begun in the early spring. H.

ST. PAUL, MINN.—A committee composed of C. L. Kluckhohn, L. A. Guiterman, C. J. McConville, C. P. Power and P. W. Herzog has been appointed to have in charge the plans for a cross-town car line for this city.

VALPARAISO, IND.—Elmer J. Binford, president of the Indianapolis, Chicago & Meridian Electric Railway, announces that right of way has been secured and has given assurance that construction work will be started early in the spring. S.

OAKLAND, CAL.—The San Francisco-Oakland Terminal Railways has been granted a certificate of public convenience and necessity to exercise franchise rights to operate a street railroad along Standard Avenue and on a private right of way in the city of Richmond.

PADUCAH, KY.—The Calloway Circuit Court has granted to the Kentucky Southwestern Electric Railway, Light & Power Company a franchise for an interurban railroad through that county. The first division, which will run from Paducah to Murray, will be built this spring. Preparations are now being made to float $1,000,000 in bonds.

LAPORTE, IND.—A new interurban railroad has been organized to build and operate a traction line from Laporte, to Logansport, to be known as the Laporte, Logansport & Southern Railroad. The capitalization is $100,000. Ora Bosserman is president, Warren Travis, vice-president, and Carl Loetz, secretary. An Eastern syndicate will finance the project, and the work of surveying the line will begin at once. S.

DOVER, DEL.—The American Railways Company has filed articles of incorporation with a capital stock of $25,000,000. The incorporators are named as Charles U. Martin, J. F. Shrader and George H. Stein, all of Philadelphia. The purpose of the

company is to carry on the business of constructing and equipping railways of all kinds, operated by steam or electricity, and operated wholly without Delaware.

MASON CITY, IOWA.—The United Light & Railway Company has purchased the properties of the Mason City & Clear Lake Railway Company and the People's Gas & Electric Company of this city, the Mason City heating plant and kindred holdings controlled by the Brice interests. The first improvement contemplated by the new owners is the extension of the interurban line to Charles City, to connect with the Illinois Central.

FARMINGTON, ME.—Elmer E. Richards, Farmington; O. B. Head, New Sharon; W. H. Roran and C. E. Varney, Mercer; H. L. Sawyer, Smithfield; Albert L. Kavanah, Lewiston; W. L. Walker, Skowhegan; M. Sweet and George F. Marshall, of Boston; are named as the incorporators of a company with $300,000 capital stock which has been organized under the name of Farmington-Oakland Interurban, to build an electric railway between the two places.

OKLAHOMA CITY, OKLA.—A state charter has been granted to the Kansas-Oklahoma Traction Company of Nowata, with $100,000 capitalization. The purpose of the company is to construct an interurban road from Coffeyville, Kans., to Tulsa *via* Nowata. The estimated length of the road is 70 miles and will cost in the neighborhood of $40,000 per mile. The incorporators are D. H. Siggins, H. A. Siggins, Warren, Pa.; W. E. Zeigler, Coffeyville, Kans., J. E. Campbell and E. B. Lawson, of Nowata.

SEATTLE, WASH. — Jacob Furth, head of the traction properties in this city, has announced that the Stone & Webster Engineering Corporation is at the present time investigating the feasibility of building an interurban line north from Bellingham into the rich Nooksack Valley, and in all probability it ultimately will be extended to Vancouver, B. C. This road will furnish a direct outlet from Bellingham to the best farming district in the country, and also it will connect Bellingham with practically all the important towns in Whatcom County. The company's plans contemplate the building of the present interurban from its present terminus at Mt. Vernon southward to Everett, thereby closing the only missing link between Bellingham and Tacoma. O.

SAN FRANCISCO, CAL.—At a joint meeting of the Public Utilties Committee and the Exposition Transportation Committee the following action was decided upon. The supervisors will be asked to call upon the city engineer to prepare plans for the complete system of municipal street car lines not only to handle the exposition traffic, but to provide for the transportation needs of the outlying districts of the city. This plan will include the Van Ness Avenue line, the Stockton Street line, with the Stockton Street tunnel and the Columbus Avenue extension to Bay Street; the extensions of the Union Street line and the Embarcadero line. The Harbor Commissioners, through President Dwyer, promised to build the Embarcadero railroad, construct the Fort Mason tunnel and arrange independently of city and corporations, a waterfront express train service between the Ferry Building and the Exposition grounds.

PROPOSALS.

FIRE-ALARM SYSTEM. — Sealed proposals will be received by the Supervising Architect, Washington, D. C., until March 17 for a noninterrupting local fire-alarm system at the appraiser's warehouse, New York City, in accordance with specifications, copies of which may be obtained from the Supervising Chief Engineer, New York City, or the Supervising Architect.

GENERATOR AND SWITCHBOARD ACCESSORIES.—Sealed proposals indorsed "Proposals for Motor Generating Set," will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 22 for one 200-kilowatt motor generator set and switchboard accessories at the Naval Station, Pearl Harbor, H. T. Specifications may be obtained from the Bureau.

ELECTRICAL WIRING AND FIXTURES. — Sealed proposals indorsed "Proposals for Telephone Exchange Building" will be received at the office of the Quartermaster, Fort Sam Houston, Tex., until March 19 for the electrical wiring and fixtures in a telephone exchange building at Fort Sam Houston. Bidders must state names of manufacturers whose goods they propose to furnish.

POLE LINE, EXTERIOR LIGHTING SYSTEM, ETC.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 22 for the construction of a pole line, exterior lighting system, interior wiring system and lighting fixtures for the United States Quarantine Station at Galveston, Tex., in accordance with drawings and specifications, copies of which may be obtained from the custodian of the site or at the discretion of the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 31 for the electric conduits and wiring and interior lighting fixtures of a two-story building for the post office at Concordia, Kans.; until April 1 of a two-story building for the post office at Rolla, Mo.; until April 4 of a one-story building for the post office at Ottawa, Kans. Drawings and specifications may be obtained from the custodians of the sites or from the office of the Supervising Architect.

WIRE AND CABLE.—Sealed proposals will be received March 5 under Proposal 640 by the Chief Signal Officer, War Department, Washington, D. C., for furnishing 350 spools buzzer wire, ¼-mile per spool; 10,000 feet single bridle wire No. 16, 10,000 feet twisted pair bridle wire, 25,000 feet outside distributing wire, 300 spools buzzer wire, single insulated; 75,000 feet inside twisted pair wire, 20,000 feet type 251, one pair rubber insulated lead sheathed, galvanized flexible steel armor cable, and 5,000 feet rubber-covered and braided single wire. Further information may be had upon application to W. L. Clark, captain, disbursing officer.

ELECTRIC AND TELEGRAPH SUPPLIES.—Sealed proposals will be received by the Chief Signal Officer, War Department, Washington, D. C., under Proposal 641, until March 7 for furnishing 100 buzzars, 100 strap keys, 21 pliers, 100 spiral springs or relays, 100 ditto for telegraph sounders, 20 terminals, 400 pounds rubber tape, 750 pounds friction tape, 150 tubular fuses, 75 extension bells, 12 terminal strips, 10-pair, and 12 ditto 20-pair, 250 bridle rings, 500 pounds bluestone, 50 fuse clips, 100 standard ditto, 20 pounds compound, 150 w. e. No. 24 fuses, 12 plugs, 40,000 paper sleeves, 200 choke cells, 250 heat coils, 24 signal line coils, 100 tubular fuses and 25 w. e. signals. Further information may be had upon application to W. L. Clark, captain, disbursing officer.

NEW INCORPORATIONS.

LANSING, MICH.—W. F. Bohnet Electric Company has filed articles of incorporation with a capital stock of $10,000 to deal in electrical supplies.

PRAIRIE DU SAC, WIS.—Prairie du Sac Light & Mill Company has been incorporated with a capital stock of $25,000 by C. E. Blake, Minnie Fitzgerald and J. B. Sanborn.

AUBURN, N. Y.—Kilmer-Richardson Company, Incorporated, has been incorporated with a capital stock of $15,000 by Joseph A. Kilmer, Thomas S. Richardson and Nelson L. Drummond, all of this city.

GALESBURG, ILL. — Galesburg Utilities Company has been incorporated with a capital stock of $5,000 to do a general electric light, telephone and telegraph business. The incorporators are George B. Churchill, F. C. Woods, Lafayette Weinberg.

ELYRIA, O.—The Elyria Electric Company has been incorporated with a capital stock of $10,000 to deal in electrical supplies. The incorporators are Henry Theman, W. H. Murbach, H. A. Wentz, and others.

WEST ORANGE, N. J.—The Edison Storage Battery Supply Company has been incorporated with a capital stock of $100,000 to manufacture electric fixtures. The directors are Harry F. Miller, William S. Bee and William H. Meadowcraft. A.

NEW YORK, N. Y.—Eden Specialties Corporation has been incorporated with a capital stock of $25,000 to deal in electrical devices. The incorporators are James B. Kissam, Bradford Darrach, Jr., and Fred E. Hazard, all of New York City.

NEW YORK, N. Y.—Electric Fire Alarm & Signal Company, Incorporated, has filed articles of incorporation with a capital stock of $10,000 by Joseph Norden, Mortimer Norden, and Jacob B. Hanover, New York, N. Y.

ROCHESTER, N. Y. — Zimbrich Lighting Company, Incorporated, has been granted a charter with a capitalization of $25,000 to deal in electric light fixtures, etc. The incorporators are Albert M. Zimbrich, Mabel Zimbrich and Charles E. Bostwick.

INDIANAPOLIS, IND. — The George Loring Company has been incorporated with a capital stock of $10,000 for the purpose of manufacturing and selling electrical machinery. George Loring, Ralph S. and Grace S. Howell and Charles M. Reagan are the directors of the company.

DAYTON, O.—The L. C. R. Storage Battery Company has been incorporated with a capital stock of $30,000 to engage in the business of storage batteries, electric lighting systems, specialties and accessories. The incorporators are Samuel Loucks, Arthur G. Christy, Frank D. Reeder, Frank P. Brown and David L. Prugh.

FINANCIAL NOTES.

President McCall, of the Philadelphia Electric Company, announces that the offer of the United Gas Improvement Company to lease the Electric Company for 99 years on terms which would yield eight per cent on $17,500,000 Electric Company stock, has been rejected.

The $5,822,000 Toledo Traction, Light & Power six-per-cent, five-year, first-lien bonds, issued under the reorganization of Toledo Railways & Light by Henry L. Doherty & Company, of New York City, and offered at par and interest by Harris, Forbes & Company, have been oversubscribed.

The New York Stock Exchange has admitted to list the Kings County Electric Light & Power Company subscription receipts for six-per-cent convertible debenture bonds, issue of 1912, due 1925, full paid and part paid.

In connection with financing Chicago Railways requirements for 1913, Harris, Forbes & Company, New York City, will take an additional $4,000,000 of Chicago Railways first-mortgage, five-per-cent gold bonds dated February 1, 1907, and due 1927. These bonds are issuable only for extensions and improvements approved by the board of supervising engineers in accordance with the provisions of the city ordinance of February, 1907. This ordinance provides that the valuation of the company's property shall always be at least $30,779,875 in excess of the first mortgage bonds outstanding. Sale of $4,000,000 of these first mortgage bonds will bring the amount outstanding up to approximately $50,000,000.

Dividends.

American Telegraph & Cable Company; the regualr quarterly dividend of 1.25 per cent, payable March 1 to stock of record February 28.

Cities Service Company; the regular monthly dividends of five-twelfths of one per cent on the common stock and one-half of one per cent on the preferred stock, payable March 1 to stock of record February 15.

General Electric Company; a regular quarterly dividend of $2 per share, payable April 15 to stock of record March 1.

The New England Telephone & Telegraph Company; the regular quarterly dividend of $1.75, payable March 31 to stock of record March 15.

Northern Ohio Traction & Light Company; a quarterly common dividend of 1.25 per cent, payable March 15 to stock of record February 28.

Reports of Earnings.

TOLEDO TRACTION, LIGHT & POWER.

The earnings of the Toledo Railway & Light Company, which has been reorganized and taken over by the Toledo Traction, Light & Power Company, for the year ended December 31, 1912, compares as follows:

	1912	1911
Gross earnings	$3,979,275	$3,339,372
Expenses and taxes	2,789,428	2,324,838
Net earnings	1,189,847	1,014,534
Interest paid, etc.	569,550	820,424
Surplus	620,297	194,110

VIRGINIA RAILWAY & POWER.

The Virginia Railway & Power Company for January, 1913, and the seven months ended January 31, 1913, reports earnings as follows:

	1913	1912
Gross earnings	$ 410,452	$ 368,464
Net earnings	197,299	165,866
Surplus	78,948	52,490
Seven months' gross	2,855,362	2,699,918
Seven months' net	1,434,332	1,267,170
Seven months' surplus	617,620	483,292

There has been charged against operating expenses in 1912-13 $8,333.33 monthly for depreciation.

AMERICAN TELEPHONE & TELEGRAPH.

The American Telephone & Telegraph Company of New York has issued its report for the year ended December 31, 1912. The income account compares as follows:

	1912	1911
Earnings	$689,379	$607,753
Expenses	575,639	497,184
Net	*113,740	110,568
Dividends	76,888	76,888
Surplus	36,852	33,681

*Equal to 2.96 per cent earned on $3,844,700 capital stock, as against 2.88 per cent earned on same stock previous year.

KINGS COUNTRY ELECTRIC LIGHT & POWER COMPANY.

The annual report of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company, of Brooklyn, show comparative combined earnings for 1912 and 1911 as follows:

	1912.	1911.
Gross operating revenue	$5,167,669.38	$4,707,914.59
Operating revenue deductions:		
Operating expenses, excepting taxes and depreciation charges	2,268,674.93	1,942,776.70
Depreciation charges	700,639.57	605,377.56
Taxes	410,028.44	380,295.85
	3,379,342.94	2,928,450.11
Net operating revenue	1,788,326.44	1,779,464.48
Net non-operating revenue	62,502.28	75,363.55
Gross income	1,850,828.72	1,854,828.03
Income deductions:		
Interest on funded debt	846,560.00	806,892.53
Interest on Unfunded debt	32,115.33	3,309.96
Bond discount written off	20,268.81	20,268.81
	898,944.14	830,471.30
Net income	951,884.58	1,024,356.73
Dividends	800,000.00	800,000.00
Payment to Edison investment fund in accordance with employes' profit sharing plan	48,711.35	45,674.50
Other appropriations	1,764.43	393.54
	850,475.78	846,068.04
Balance to credit of profit and loss	101,408.80	178,288.69
Previous profit and loss balance	1,599,976.60	1,416,182.74
Plus adjustment of accounts previous years	4,283.14	5,505.17
Total profit and loss balance	$1,705,668.54	$1,599,976.60

On December 31, 1912, the company had 33,973 customers, an increase of 5,916 over the previous year. There were total connections in 50-watt equivalent of 2,452,410, an increase of 310,346. Power business contracted for amounted to 18,209, an increase for the year of 2,319 contracts. This represents a total connected horsepower of 23,595, an increase of 3,755 horsepower. This gives the company a total lighting and power, in 50-watt equivalents, of 960,221. The total kilowatt-hours generated in 1912 was 122,178,545.

AMERICAN DISTRICT TELEGRAPH COMPANY.

The report of the American District Telegraph Company of New York for the year ended December 31, 1912, shows net earnings of $113,740 against $110,568 in 1911. This is equal to 2.96 per cent of the capital stock, as compared with 2.88 per cent earned the previous year. The income account compares as follows:

	1912	1911
Earnings	$689,370	$607,753
Expenses	575,639	497,184
Net	113,740	110,568
Dividends	76,888	76,888
Surplus	36,852	33,681

SOUTHERN BELL TELEPHONE.

The Southern Bell Telephone & Telegraph Company for the year ended December 31, 1912, reports earnings as follows:

	1912	1911
Gross earnings	$7,454,295	$7,202,056
Operating exp. and taxes	4,750,626	4,923,346
Net earnings	2,703,669	2,278,710
Bond interest	638,700	638,700
Surplus	2,064,969	1,640,010

The Southern Bell Telephone & Telegraph Company has $21,400,000 capital stock, substantially all of which is owned by the American Telephone & Telegraph Company and on which dividends of six per cent are paid. It also has $12,744,000 first-mortgage, five-per-cent bonds outstanding, due January 1, 1941.

NATIONAL CARBON COMPANY.

The report of the National Carbon Company for the year ended December 31, 1912, shows net earnings of $1,261,203, against $931,145 in 1911. The balance available for common dividends was $946,203, equal to 17.2 on the stock, as compared with 11.2 earned the previous year. The income account compares as follows:

	1912	1911
Net earnings	$1,261,203	$931,145
Preferred dividend	315,000	315,000
Balance	$946,202	$616,145
Common dividends	330,000	330,000
Balance	$616,204	$286,145
Depreciation, etc.	366,094	241,974
Surplus	$250,110	$44,171

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 24.	Feb. 17
American Tel. & Tel. (New York)	132	133⅛
Commonwealth Edison (Chicago)	142	142
Edison Electric Illuminating (Boston)	*282	282
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery Common (Philadelphia)	51¼	52½
Electric Storage Battery preferred (Philadelphia)	51¼	52½
General Electric (New York)	137½	139
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1¼	1⅝
Massachusetts Electric common (Boston)	16½	17
Massachusetts Electric preferred stamped (Boston)	*77½	77½
National Carbon common (Chicago)	*121	121
National Carbon preferred (Chicago)	*116	116
New England Telephone (Boston)	*157	157
Philadelphia Electric (Philadelphia)	22⅞	23½
Postal Telegraph and Cables common (New York)	83	86
Postal Telegraph and Cables preferred (New York)	67	67
Western Union (New York)	67⅛	70⅛
Westinghouse common (New York)	69⅜	71
Westinghouse preferred (New York)	117	118

*Last price quoted.

PERSONAL MENTION.

PETER COOPER HEWITT, inventor of the Cooper Hewitt system of lighting, is enjoying a rest abroad, and will return to his laboratory in New York City early in March.

W. M. S. MILLER, formerly publicity manager of the Allis-Chalmers company, has taken charge of the publicity department of the Independent Electric Manufacturing Company, Milwaukee, maker of "I. C." controlling devices.

J. D. LYON, commercial manager of the Union Gas & Electric Company, of Cincinnati, O., has resigned his position, effective March 1. He has been with the company for two years. His plan is to establish an office as consulting mechanical engineer.

JAMES M. WAKEMAN, who has been quite ill at his residence in Orange, N. J., from blood poisoning, is now convalescent, and will soon resume his duties as general manager of the Electrical Development Society, in the Engineering Societies Building, New York City.

M. H. MOFFETT, assistant sales manager of the National Carbon Company, Cleveland, Ohio, delivered an illustrated lecture on "The Modern Dry Cell," at the La Salle Hotel, Chicago, on Wednesday, February 19, in conjunction with the convention of the National Independent Telephone Association.

THEODORE N. VAIL, president of the American Telephone & Telegraph Company and the Western Union Telegraph Company, has fully recovered from his recent operation, and after a brief period of active work at his offices in New York City, will take a rest of several weeks on his yacht, in the West Indies.

T. P. SYLVAN, secretary of the Employees' Benefit Fund Committee of the American Telephone & Telegraph Company, addressed the Telephone Society of New York at its one-hundred and forty-second meeting on February 19, on the subject of "Some Phases of the Employees' Pension, Disability and Insurance Plan."

F. H. GALE, at the head of the publicity department of the General Electric Company, spoke on "Special Issues" before the Technical Publicity Association, at its meeting held in New York City, Thursday evening, February 13. Daniel T. Pierce, of the McGraw Publishing Company, responded from the point of view of the publisher.

E. O. SESSIONS, the well known consulting engineer, will retire as a member of the firm of Woodmansee, Davidson & Sessions on March 1. Mr. Sessions is a Fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers, associate member of the American Society of Civil Engineers and a member of the Illuminating Engineering Society. Mr. Sessions will announce his plans for the future at an early date.

DR. E. G. ACHESON, inventor and chemist, was tendered a dinner at the American Embassy at St. Petersburg, Russia, and was presented with the insignia and a sash of the Order of St. Ann, this distinction being conferred through Premier Kokovtsoff by the Czar. Dr. Acheson went to Russia primarily to address the Russian Imperial Technological Institute on the nature and use of his lubricant. The Order of St. Ann was created by Charles Frederick, Duke of Schleswig-Holstein Gottrop in 1735, in memory of Empress Ann, and adopted as a Russian order by Emperor Paul I, April 5, 1797.

ALEXANDER C. HUMPHREYS, president of Stevens Institute of Technology, Hoboken, N. J., was the guest of honor on Friday evening, February 14, at the banquet of the Stevens Alumni, at the Hotel Astor, New York City. The event celebrated the tenth anniversary of Dr. Humphrey's presidency of Stevens Institute, and a number of interesting and prophetic addresses were delivered, among the speakers being presidents of other universities and gentlemen associated in business and professional life with Dr. Humphreys. There were over 700 present at the banquet, and the boxes were filled with ladies, including the wife of the chief guest who had to acknowledge applause and cordial greetings from all.

JOHN W. LIEB, JR., was tendered a dinner at Louis Martins, New York, prior to the meeting of the New York Companies Section of the National Electric Light Association, on February 17, at which he delivered an address on "Rates." Among those present were Thomas E. Murray, of the New York Edison Company; R. A. Carter, vice-president of the Consolidated Gas Company; H. M. Edwards, of the New York Edison Company; Arthur Williams, of the New York Edison Company; T. C. Martin, secretary of the National Electric Light Association; T. I. Jones, of the Brooklyn Edison Company; W. J. Clark, of the Westchester Lighting Company; W. E. McCoy, of the United Electric Light & Power Company; L. A. Coleman, of the United Electric Light & Power Company; F. W. Smith, of the United Electric Light and Power Company; J. F. Becker, of The United Electric Light & Power Company; H. L. Snyder, of the New York & Queens Electric Light & Power Company, and S. E. Doane, chief engineer, Engineering Department of the National Electric Lamp Association.

OBITUARY.

WILLIAM G. SCOTT, a pioneer in the development of the telephone system, of New York, was buried on February 17 from his late residence, at Port Richmond, Staten Island. He began his career with the American District Telegraph Company, and later went with the New York Telephone Company. He played a prominent part in the elimination of telephone poles and the laying of the first telephone cables.

EDWARD L. CLARK, for many years auditor of the General Electric Company, died at his home in Schenectady, N. Y., February 15, after a lingering illness. The late Mr. Clark was born in Edinburg, Scotland, and, in 1849 and for several years was employed by the Telephone Company of London with Samuel Insull and other well known men now considered pioneers in the electrical industry. In 1884 Mr. Clark came to America and was employed by Thomas A. Edison as auditor of the Edison Electric Light Company in New York City, one of the very first electric-light stations in the world. In December, 1891, he became auditor of the Edison General Electric Company. He had full charge of the arduous work of consolidation of accounts when the General Electric Company was organized in 1892 by merging the Edison General Electric Company and the Thomson-Houston Electric Company. Two years later Mr. Clark was made assistant to the comptroller, the late J. P. Ord, and soon thereafter was made general auditor of the company and continued in that capacity until his death. Mr. Clark was well known throughout the electrical industry, having a large personal acquaintance among those men who have been foremost in the development of the electrical industry. He is survived by a widow and two sons, Thomas S., of Schenectady, and Edward Jr., of Charlotte, N. C.

NEW PUBLICATIONS.

BULLETIN OF THE DEPARTMENT OF EXAMINATIONS AND REPORTS.—The first of a series of bulletins concerning the Examination and Report Department of H. M. Byllesby & Company, Chicago, is being mailed to electric, gas and street railway companies, banks and trust companies and others interested in the operation of public-utility companies in the United States and Canada. It is the purpose of the first bulletin, and succeeding issues, to describe the work of the department and make clear the service it offers.

DATES AHEAD.

The Society for Electrical Development, Incorporated. Special general conference, New York, N. Y., March 4-5.

Boston Automobile Show, Mechanics Building, Boston, Mass., March 8-22.

Minnesota Electrical Association. Annual convention, St. Paul, Minn., March 11-13.

Electrical Committee, National Fire Protection Association. Annual meeting, New York, N. Y., March 26-27.

American Electrochemical Society. Spring meeting, Hotel Traymore, Atlantic City, N. J., April 3-5.

Mississippi Electric Association. Annual convention, Natchez, Miss., April 21-23.

Iowa Electrical Association. Annual convention, Waterloo, Ia., April 23-24.

The Society for Electrical Development, Incorporated. Annual meeting, New York, N. Y., May 13.

National Fire Protection Association. Annual meeting, New York, N. Y., May 13-15.

Association of Railway Telegraph Superintendents. Annual meeting, St. Louis, Mo., May 20.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 21-24.

Electrical Supply Jobbers' Association. Spring meeting, Chicago, Ill., May 26-28.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

National Electric Light Association. Annual convention, Chicago, Ill., June 2-5.

Canadian Electrical Association. Annual convention, Port Arthur and Fort William, June 23-25.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16.

With the Electrical Manufacturers

The Adapti Manufacturing Company is the new name which has been assumed by the Bonnell Manufacturing Company, Cleveland, O. This change in name does not involve any change of interest or management. The name is to be written ADAPTi by the company, as a distinctive characterization.

The Okonite Company, New York, N. Y., announces that under the direction of its engineer, L. G. Martin, the city of Atlanta, Ga., is having installed a complete police and fire-alarm system. Okonite insulated wire is used throughout the city and the work will probably be completed about the beginning of next June.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has issued a circular briefly pointing out the advantages and giving all necessary data of its new malleable-iron slotted hickey. Data are also given of the old-style hickeys. Both these types are made suitable for pipe sizes from one-eighth to one-half inch.

Cling-Surface Company, Buffalo, N. Y., has issued a bulletin entitled "Cling-Surface Treatment for Ropes." This bulletin shows and describes a number of noteworthy cases of treated rope drives and gives technical data respecting them. A copy of the bulletin may be obtained upon application to the company.

Sangamo Electric Company, Springfield, Ill., is distributing a new bulletin, No. 34, descriptive of its complete line of single-phase and polyphase induction watt-hour meters. This bulletin is one of the most complete which has as yet been issued on the subject and will be appreciated by central-station meter superintendents desiring complete information on the latest metering developments.

The American Conduit Company, East Chicago, Ind., manufacturer of bituminized fiber conduit for underground construction for electric light, telephone and railway signal systems, has published a very complete and interesting study relating to underground conduit construction. This has been arranged by Arthur G. McClure of the New York office of the company. Copies of this work will be sent to those interested in conduit construction, upon request.

The Standard Electric Tool Company, Cincinnati, O., has issued two new bulletins, Nos. D-8 and D-9. Of these the former describes Standard high-power direct-current portable electric drills which are now made for drilling from one-quarter to seven-eighth-inch holes in steel, or up to 1.25-inch holes in wood. The second bulletin describes the company's two-phase and three-phase portable electric drills which embody the same general principles of construction as the direct-current drills.

Universal Electric Stage Lighting Company, 238 West Fiftieth Street, New York City, has issued two new publications dealing with the Kliegl electric stage-lighting apparatus. One of these describes the Klieglight arc lamp, particularly suitable for motion-picture work, although also used effectively for studio and other purposes. In a supplement of its catalog F are described the latest types of Kliegl stage pockets and plugs. These are made in a variety of forms and sizes to meet the great many different conditions required for stage connections.

Engineering Department of the National Electric Lamp Association, Cleveland, O., has issued in four-page form a chart designed to facilitate the solution of problems in general illumination. Given the intensity of illumination required, the color of the walls and the dimensions of the space to be lighted, by referring to the chart one is able to select the most desirable size of Mazda lamp, and the spacing of units to give satisfactory results. This chart will be found a convenience by lamp people who have occasion to do specification work in illumination. Copies can be obtained from the Engineering Department on request of those interested.

The National Metal Molding Company, Pittsburgh, Pa., has issued a new catalog devoted to National metal molding. This modern electric construction material is now available complete with couplings and fittings of every description so that every requirement of construction may be expeditiously handled. The material is ready, together with fittings, in large quantities and stocks are available for quick shipment to every part of the country. The catalog describes and illustrates the methods of construction with National metal molding, and indicates the relation of one part to the other. This catalog may be secured upon request.

The General Railway Equipment Company and its subsidiary, the United States Electric Company of New York, are the principals in bankruptcy petitions filed on February 18. The General Railway Equipment Company was incorporated under the laws of Maine in April, 1912, with an authorized capital stock of $15,000,000. It was formed to combine several companies manufacturing railway equipment. It was later stated that the company had authorized the issue of $1,500,000 preferred and $4,500,000 common stock. This was to provide for a working capital and for the equipment free and clear of all indebtedness of the following companies which have an outstanding capital stock of $2,150,000; United States Electric Company, Electric Switch and Signal Company, National Telephone Selector Company, Charter Electric Company, Sandwich Electric Company, Sandwich Pole-Changer Company, and the International Telegraphic Call Company. George M. Sealy was made president and Charles N. Sigison, treasurer.

Gurney Elevator Company, 64 West 45th Street, New York City, has issued Bulletins 4 and 5, describing the Gurney traction elevator. These bulletins have been prepared by H. F. Gurney, president of the company. The Gurney type traction elevator has been particularly designed for high-speed elevator service and is claimed to be an absolutely safe elevator of the highest efficiency and at the same time great simplicity, reliability and smoothness of operation. The connection between the motor and traction sheave is by means of helical or herringbone gears, thus permitting of great compactness, high efficiency and high gear ratio. Bulletin 4 describes the various features of the mechanism, including controller, motor, gearing and safety devices. Bulletin 5 is particularly devoted to an engineering demonstration of the advantages of the Gurney type traction elevator system. It goes into an analytical discussion of the various parts of the equipment, stating why they were selected and giving the different advantages of each.

General Electric Company, Schenectady, N. Y., has issued a number of new publications, among which the following are notable: Bulletin A4072 is devoted to sign lighting by means of Edison Mazda sign lamps. This bulletin contains reproductions of photographs of various styles and sizes of signs located in many cities of this country. The various lamps suitable for sign service are described and illustrated, also several types of sign receptacles. Methods of wiring signs and other useful information on the subject are included.—Bulletin A4070 describes the new type R, form C2 electrically operated remote-controlled switch, which is adapted for use wherever control from a central point is desired. This switch is made for both alternating and direct currents.—Bulletin A4081 describes and illustrates reversing motors and their control equipment for planers, slotters and similar reversing machinery. This publication shows the advantages of direct drive over belt drive and describes in some detail the system developed by the company. Parts of the equipment and also general views of its complete installation are shown.—Bulletin A4083 is devoted to type US-13 roller-bearing trolley bases.—Bulletin A4085 treats of battery-charging motor-generator sets for railway signaling. Full data, dimension diagrams, detailed views and descriptive matter are given.—Bulletin A4086 is devoted to circuit-breakers of the type MR for railway service. These are especially designed for use on cars and have capacities up to 400 horsepower.

Record of Electrical Patents.

Issued by the United States Patent Office, February 18, 1913.

1,053,144. Electric Locomotive for Coal Cars for Use in Mining. E. Armentrout, Borderland, W. Va. Has a trolley and also a reel for winding up a flexible supply cable.

1,053,164. Magneto Interrupter. W. E. Dow, Braintree, Mass. Associated with the rotor of the magneto.

1,053,174 to 1,053,177. Pull Socket. H. Hubbell, Bridgeport, Conn. In the first of these patents the operating lever may be fulcrumed for either upright or pendent use. In the second patent this is accomplished through a swiveled joint and reversible bracket for the lever. The third patent relates to a lateral-extension bracket for the lever. The fourth relates to a connecting bar between the operating lever and mechanism.

1,053,178 and 1,054,179. Operating Mechanism for Pull Sockets. H. Hubbell, Bridgeport, Conn. These patents relate to some of the details referred to in the foregoing.

1,053,219. Rheostat. T. Rhodus, Chicago, Ill. Includes a ring-shaped resistance on the edge of which bears a grooved contact wheel swung about on a rotating arm.

1,053,242. Resistance Device. H. G. Thompson, Glen Ridge, N. J., assignor to Safety Car Heating & Lighting Co. A group of resistances is mounted in a box so they may be adjustably connected to one or more circuits.

1,053,245. Electric Switch. M. E. Turner, East Cleveland, and R. A. Fulton, Cleveland, O. Includes a trigger and spring-controlled plunger.

1,053,248. Interrupter for Magneto-Electric Igniters. G. Unterberg, Frankfort-on-the-Main, Germany. Has a rotating circuit-breaking lever.

1,053,266. Electrolytic Cell. E. O. Barstow, Midland, Mich. Includes a bipolar electrode plate of carbon with independent carbon pins on each face.

1,053,280. Electric Cooker. L. G. Copeman, assignor to Copeman Electric Stove Co., Flint, Mich. The cooking utensil can be locked to the heating unit and stand by rotation.

1,053,301. Electric Paper Perforator. W. J. Koster, Peterboro, Ont., Canada, assignor of one-half to R. C. Braund. Electromagnets control the perforating arm.

1,053,306. Electric Mail Exchange. W. Lewis, Kampeska, S. D. Includes an endless series of mail-receiving pockets.

1,053,311. Safety Device for Controllers. J. F. Miller and W. V. Turner, Edgewood, Pa. A dashpot-controlled device for locking the controller handle.

1,053,319. Vegetable-Peeling Machine. H. Robinson, South Orange, N. J. Driven by a motor in the bottom compartment of the machine.

1,053,320. Cleaning and Polishing Machine. I. K. Roby, Staunton, Va. A cylindrical shell is driven by a motor within it.

1,053,330. Station-Indicator for Railways. H. M. Van Demark, Brooklyn, N. Y. Is operated by electromagnets that are energized through contacts adjoining the trolley wire.

1,053,331. Electric Cloth-Cutting Machine. E. M. Waring, Brooklyn, N. Y. An electric motor operates the knife.

1,053,338. Block System for Railways. C. Woods, Kansas City, Mo. Includes a number of train-controlling contacts between rails at each end of each block.

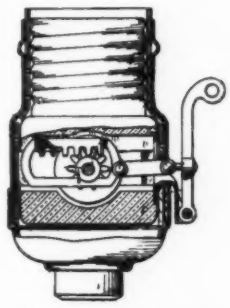
1,053,340. Electromagnet. A. A. Ziegler, Boston, Mass. An S-shaped armature rotates between specially arranged pole pieces.

1,053,354. Locking Mechanism for Electric Lamp Sockets. W. Broad, Beaver Falls, Pa. The bulb must be broken so that the casing drops and releases the concealed locking sleeve; otherwise the screw shell rotates.

1,053,362. Block-Signal System. E. R. Cunningham, Des Moines, Ia., assignor of one-third each to E. B. Beighler and F. C. Tate. A semaphore system controlled through sections of the trolley wire.

1,053,390. Galvanic Cell. A. Heil, assignor of one-half each to C. Hubert and S. Stern, New York, N. Y. The depolarizer is dark-brown manganic hydrate mixed with carbon.

1,053,392. Combination Metallic and Carbon Electrode Holder. G. Hills, Westfield, N. J., assignor to C. & C. Electric & Manufacturing Co. A metal tube at the end of a handle holds both electrodes.



1,053,175.—Pull Socket.

1,053,393. Process of Measuring the Energy of Engines Within the Cylinder. O. E. Hintz, Bellevue, Ia. The motion of the piston is caused to generate an alternating current influenced also by the pressure on the piston, the resulting electrical energy measuring the energy of the engine.

1,053,395. Ignition Arrangement for Internal-Combustion Engines and Other Purposes. H. A. Humphrey, London, Eng., assignor to Humphrey Gas Pump Co. An electric ignition system.

1,053,430. Detector for Party-Line Telephones. J. W. Nilsson, Balfour, N. D. Movement of the receiver arm closes a circuit and actuates a buzzer and motor-operated disk.

1,053,468. Incandescent Lamp-Cleaning Machine. G. W. Beadle, East Orange, N. J., assignor to Westinghouse Lamp Co. The wipers are caused to reciprocate while the lamp is rotated in a chuck.

1,053,470. Electric Spark Plug. F. R. Blake, assignor to Blake Spark Plug Co., Boston, Mass. Covers details of construction.

1,053,484. Electric Controller. A. C. Eastwood and J. H. Hall, assignors to Electric Controller & Manufacturing Co., Cleveland, O. The shunt-field rheostat is short-circuited until all armature resistance is cut out.

1,053,489. Electric Switch. H. E. Frost, assignor to Electric Controller & Manufacturing Co. Is electromagnetically operated.

1,053,494 and 1,053,495. Circuit-Controlling System. J. H. Hall, assignor to Electric Controller & Manufacturing Co. The first patent provides an automatic switch for a manual controller which opens the circuit when the motor current is excessive. The second patent provides for shunting the windings of automatic motor-control switches when the current is excessive.

1,053,496 to 1,053,498. Electric Controller. J. H. Hall, assignor to Electric Controller & Manufacturing Co. The first of these patents is a modification of No. 1,053,484. The second and third patents relate to series-parallel drum-type controllers.

1,053,499. Electric Control System. J. H. Hall, assignor to Electric Controller & Manufacturing Co. A reversing controller.

1,053,500 to 1,053,503. Electric Controller. J. H. Hall, assignor to Electric Controller & Manufacturing Co. First patent deals with a pair of reversing series motors operated in a closed loop. Second patent relates to a special interconnection of resistance and control-switch windings. Third patent covers a lock-out arrangement to prevent operation of the controller if any resistance switch has remained closed. Fourth patent relates to an automatic series-parallel controller.

1,053,509. Brake Mechanism for Ore-Handling Apparatus. F. K. Hoover and A. J. Mason, Chicago, Ill. Electric control for the wheel chock blocks.

1,053,538. Shade-Holder for Incandescent Electric and Other Lamps. D. G. Saunders, Jr., Kansas City, Mo. Consists of clamping and shade-holding rings connected by arms and each held closed by springs.

1,053,550. Electric Water-Heater. E. M. Wright and R. W. Hall, Lents, Oreg. Has the heating coil in the lower part of the chamber and automatically controlled by the inlet water.

1,053,552. Electric Switch. F. Barr, New York, N. Y. Relates to some details of a pull socket.

1,053,553. Pull Socket for Electric Lamps. F. Barr, Brooklyn, N. Y. Relates to other details.

1,053,554. Cleaning Machine. G. W. Beadle, assignor to Westinghouse Lamp Co. A modification of No. 1,053,468, in which a traveling belt and rotating brush are operated on a reciprocating carriage.

1,053,563. Electric Furnace. J. M. Bocuze, Lyon, France. Electric arcs play about the crucible.

1,053,581. Electric Pneumatic Switch. J. Desmond, assignor to S. Potwin, Chicago, Ill. Air pressure on a diaphragm governs the switch.

1,053,584. Transmitter for Selective Signaling Systems. V. Durbin, assignor to Holtzer-Cabot Electric Co., Brookline, Mass. Pulsating current

produces step-by-step rotation of the selector.

1,053,591. Automatic Gate for Railway Crossings. J. R. Golden, Hammond, Ind. Is operated by an electric motor.

1,053,593. Cord-Adjuster. D. Gould, Plainville, Conn. A single piece of wire bent to form two spring clamps for holding the lamp cord.

1,053,606. Fuse. J. S. Johnston, assignor to Johnston Manufacturing Co., Utica, N. Y. A glass-case cartridge fuse that may be readily taken apart.

1,053,618. Automatic Connecting Plug. J. N. Maas, Los Angeles, Cal. A longitudinally split attachment plug with the two parts hinged together at the outer end and spring-pressed apart at the screw-shell end.

1,053,631 and 1,053,632. Apparatus for Handling Glassware. V. Mulholland, assignor to Heyl & Patterson, Pittsburgh, Pa. An endless conveyor for bottles is automatically and intermittently operated electrically.

1,053,642. Controller-Regulator for Electric Motors. J. Y. Porter, Detroit, Mich. Includes a pawl, a pawl actuator and a series of stops.

1,053,680. Compensated Dynamo-Electric Machine. L. Torda, Wilkinsburg, Pa. The compensating winding bridges each alternate field-pole-separating space and is partly imbedded in the adjacent parts of the poles only.

1,053,684. Ground-Joint Clamp. J. C. Vogel, Philadelphia, Pa. Clamps a

1,053,618.—Attachment Plug.

band about a ground pipe and secures the ground wire to it.

1,053,685. Automatic Timing Device. C. H. Warner, assignor to Warner Instrument Co., Beloit, Wis. An electrically operated race-time-recording mechanism.

1,053,689. Lighting Fixture. H. V. Willman, Chicago, Ill. A semi-indirect fixture with translucent bowl and dust-proof cover, into which sets an upturned reflector and lamp.

1,053,693. Train-Control System. J. Ames, Montrose, Ia., assignor of one-sixth each to L. C. Miller, E. Leech and T. S. Robinson. Includes sectionalized and insulated track rails.

1,053,697. Electric Lamp Socket. F. Barr, New York, N. Y. Relates to a detail of a pull socket.

1,053,722. Striking Mechanism for Clocks. B. Z. Friedman, Fort Worth, Tex. Operated by an electric motor.

1,053,743. Lamp-Socket Shell. H. T. Paiste, assignor to H. T. Paiste Co., Philadelphia, Pa. The shell has catches that can engage any of a series of recesses in the cap.

1,053,745. Distributing Canopy for Electric Wiring. J. N. Pierce, Chicago, Ill., and F. L. R. Francisco, Jersey City, N. J. The canopy is adjustably secured to an outlet box and has outlets in its walls and a cap over its opening in the head.

1,053,770. Fuse-Puller. P. D. Barager, Rochester, N. Y. To an insulating tubular arm is secured a handle and at the other end a pair of spring-pressed fuse-gripping jaws.

1,053,801. Means for Securing Rails to Metal Ties. N. C. Fetters, assignor to W. H. Morgan, Alliance, O. Has insulation between the rail and tie.

1,053,805. Trolley. J. Gosch, Buckland, Conn. Has a sleet-cleaning wheel in advance of the trolley wheel.

1,053,830. Electromagnetic Track Brake for Railway Cars. G. G. Kibbee, Forest City, Ia. Vertically movable under the car.

1,053,849. Automatic Telephone Pay-Station. W. Milford, assignor to G. C. Yocum, Scranton, Pa. Includes several spirally arranged coin guideways.

1,053,864. Automatic Telephone Exchange System. J. Peticky, Königliche Weinberge, near Prague, Austria-Hungary. Relates to the construction of the selector switches.

1,053,899. Train-Stop System. J. H. Boom, New York, N. Y., assignor of two-fifths to F. Bach and nine-hundredths to K. E. W. Bichels. Has sectional conductors along the tracks.

1,053,912. Automatic Vending Machine. W. L. Hamilton, assignor of three-fifths to I. E. Hamilton, Holyoke, Mass., and two-fifths to E. A. Hamilton, Springfield, Mass. Operated by an electric motor.

1,053,940. Universal Motor. J. Burke, Erie, Pa., assignor to Burke Electric Co. A series commutating motor suitable for both direct and alternating current.

1,053,946. Synchronizing Device. L. Gaumont, assignor to Société des Etablissements, Gaumont, Paris, France. Electric synchronizing of a phonograph and moving-picture machine.

Reissue.

13,533. Telephone Transmitter. F. Gottschalk, assignor to Gottschalk Waterproof Sanitary Transmitter Co., New York, N. Y. Original No. 977,616, dated Dec. 6, 1910. The diaphragm has a step-shaped flange.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 25, 1913.

555,068. Electric Car-Lighting Apparatus. W. Biddle, Brooklyn, N. Y.

555,073. Short-Distance Telephone Communication. W. L. Bradshaw, Cincinnati, O.

555,074. Electric Transformer. W. Carter, Louisville, Ky.

555,075. Brake Apparatus for Railway Vehicles. F. Chapsal, Paris, France.

555,076. Electric-Visual Indicator. F. W. Cole, Newton, and W. M. Chapman, Needham, Mass.

555,090. Secondary Electric Clock. F. L. Gregory, Chicago, Ill.

555,101. Electric Annunciator. J. Kips, Yonkers, N. Y.

555,112. Hanger Board for Arc Lamps. A. J. Oehring, Chicago, Ill.

555,113. Scenic-Theater Apparatus for Producing Sun Effect. A. J. Oehring and A. J. Tucker, Chicago, Ill.

555,114. Circuit Controlling Apparatus for Scenic Theaters. A. J. Oehring and A. J. Tucker.

555,120. Electrical Annunciator. F. Porath, Appleton, Wis.

555,130. Electric Welding Indicator. E. Thomson, Lynn, Mass.

555,131. Electric Riveting. E. Thomson.

555,136. Electric Elevator Controller. E. P. Warner, Chicago, Ill.

555,152. Constant-Potential Alternating Generator. W. K. Freeman, Fort Wayne, Ind.

555,160. Electric Call and Alarm Apparatus. J. P. Hartfuss, Merzig, and E. Herz, Saarbruck, Germany.

555,165. Telegraphic Repeater. L. Horton, Jr., Reading, Pa.

555,167. Electric Railway-Signal System. J. Irwin, Omaha, Nebr.

555,190. Alternating Motor. N. Tesla, New York, N. Y.

555,191. Electric Motor. E. Thomson, Swampscott, Mass.

555,192. Electric Lighting System. S. L. Trippe, New York, N. Y.

555,208. Conduit Electric Railway. M. Bridges, Seattle, Wash.

555,216. Armature Winding. W. H. Knight, Schenectady, N. Y.

555,217. Electric Signaling Device for Railroads. G. A. Lyncker, Munich, Germany.

555,222. Railway Telephone System. W. H. Nixon, Providence, R. I.

555,239. Telephone. M. Garl, Akron, O.

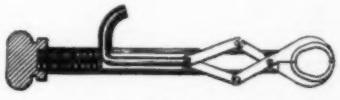
555,248. Electric Railway. W. H. Jordan, Brooklyn, N. Y.

555,252. Electrical Propulsion of Vessels. E. A. Le Sueur, Ottawa, Canada.

555,256. Underground Conductor System for Electric Railways. C. T. H. Schweiger, Berlin, Germany.

555,259. Electric Heater. J. F. McElroy, Albany, N. Y.

555,283. Contact Device for Electrically Propelled Vehicles. E. B. W. Reichel, Gross-Lichterfelde, Germany.



1,053,770.—Fuse-Puller.

555,286. Electrical Measuring Instrument. F. von Hefner-Alteneck and H. Gorges, Berlin, Germany.

555,291. System of Control for Electric Motors. E. A. Sperry, Cleveland, O.

555,301. Regulating Electric Distribution System. J. Burke, Schenectady, N. Y.

555,303 and 555,304. Primary Battery. W. A. Crowdus, Chicago, Ill.

555,305. Electric Lamp for Vehicles. W. A. Crowdus.

555,313. Electric Clock. S. Fischer. Brooklyn, N. Y.

555,320. Hanger for Signal Lanterns. E. R. Knowles, Middletown, Conn.

555,326. Electric Distribution System. E. C. Myrick, Providence, R. I.

555,332. Electric Receptacles for Flashing Powder in Flash-Light Burners. H. E. Rathbun and F. Bebby, Pawtucket, R. I.

555,381. Brush for Dynamo-Electric Machines and Motors. F. W. Kreinberg, Berlin, Germany.

555,392. Electric Motor for Street Cars. H. M. Neer, Springfield, O.

555,403. Machine for Connecting Electric Conductors. H. J. Savory, Somerville, Mass.

555,440. Illuminated Sign for Electrically Driven Street Cars. R. H. Engle, Garden Lake, N. J.

555,470. Sectional Conductor for Electric Railways. W. H. Baker, Pawtucket, R. I.

Electric Vehicle Section

Filling in the "Load Valley."

Importance of the Electric Vehicle Load and How to Secure It.

By Charles H. Seaver.

The new idea of central-station commercial management has at its very foundation the filling in of low parts of the load curve rather than raising it generally on a hit or miss scheme. There have been several proposed plans of taking care of this low point in the station load in a way that would bring forth profit, but no class of business has ever offered so much of an opportunity to the central station, large or small, as does the maintenance of the electric vehicle today. The off-peak load has already improved, yet the electric vehicle is more than an off-peak load. It is a "valley filling" load. It becomes automatically, by nature of its very peculiarities, by far the most desirable load that the average central station could possibly connect up, and certainly every effort should be made in the way of rates, special inducements and so on to attract this business.

This may seem a strong statement—but it is, none the less, true. There is at present no known load that can take the place of the electric vehicle charging load, or bring such an ample return for a small investment and a little energetic pushing. The vehicles offer an opportunity for the use of power in considerable quantities at most opportune times, and with a regularity that cannot be equaled even by a manufacturing business.

When the scope of the possible field of the electric vehicle is carefully considered, it is seen that there is hardly a town capable of supporting a lighting plant that cannot in its merchandising and transporting profitably make use of at least a few of these machines. Their advantages to bakers, butchers and grocers of the smaller cities are as real as in the larger business of the big cities where the worth of the power vehicle is already realized. Still there is an undoubted difficulty in starting the ball to rolling.

The constancy—the year-round nature of the vehicle load—is one of the strongest points in its favor, though there are so very few demands for power that can be depended upon to strike the same low portion of the load curve, that this point alone would make it desirable, even if so much dependence could not be placed upon it. The vehicles are no less valuable in the hot, dry summer months, when horses are prostrated by heat, than in the icy winter periods when hundreds of draft animals fall in the cities and a proportionately less number in smaller places. Very nearly the same load may be depended upon throughout the year for a given number of vehicles.

A good many difficulties may be expected in launching a campaign for a wider use of electric commercial vehicles, and it is not always the companies of the smaller cities who find the most trouble in this respect. There is oftentimes considerable inertia to be overcome, and strange to say this seems to be rather more in evidence in the West than in the East. Any number of good-sized Western cities are almost entirely without electric vehicles and the central stations in those cities, without apparently being aware of, it overlook one of the most valuable loads for their systems, and one of the most satisfactory uses, when properly applied, of electric power. The fact that they are not using the one hundred or two hundred electric vehicles as cities of the same size of the East are doing is not because the electric vehicle is not adapted to their needs, but simply because the proposition of using electric power for transportation has not been brought before the prospective user in the right way, and because sufficiently attractive rates are not offered.

The apathy of a good many central stations in this respect was shown by the last report of the National Electric Light Association. Of 150 central stations operating in the largest cities in the United States only 67 showed even enough interest to answer a list of questions sent out by a committee of that body, and of these only 10 companies reported as cooperating with electric automobile agents, and seven more stated that they held agencies. Less than 50 per cent of the companies answering maintained charging stations. Thus, as was stated in that report, the 11,044 commercial vehicles and 2,619 pleasure vehicles used by customers of these companies are in use, in spite of the central stations' apathy, rather than because of their activity. One of the things most needed is instruction of some sort to the people who may be made into users; and this work surely belongs to the central station.

It should be borne in mind that comparatively few people understand in any degree the electric storage battery. Many have the idea that it is an extremely delicate piece of apparatus—that if they could only get some perfected battery, then they would buy electric wagons. The battery of today is perfected as far as mileage, weight and life are concerned, and this fact cannot be too strongly brought out. There are any number of ton-and-a-half and two-ton wagons that are running 40 miles every day on a charge, and are doing this year in and year out. With proper care the batteries are long-lived and always ready to work. When one company in a city or town is making use of electric vehicles and getting good mileage, the difficulties become practically removed. Again it is the central stations' work to see that the vehicles do give good service, and to see if possible that they are properly chosen for their work. The statement of one central-station man representing the operating company in a large city of the middle west at least speaks well for companies that are just starting this line of business. He says: "Among 40 truck owners it would be impossible to find one who is not entirely satisfied with the work done by the electric machine in his service." This company offers its free services in helping a customer in the proper selection of a vehicle.

A good many central stations do not

have a very clear realization of the extent to which the electric-vehicle load may be worked up, nor the excellent returns that are offered by it. That these returns are excellent is certain from the experience of the large cities, and the good results achieved by them through proper publicity and a real cooperation with the public and the manufacturer may be reproduced on a smaller scale in places of less population. The business is worth enormously more than the difficulty of getting it started. The electric-vehicle load is an extremely economical load for a central station to handle, and attractive rates can be offered to secure business.

The exclusively off-peak nature of the demand permits charging of all commercial vehicles to be commenced after the peak has been reached so that the charge is completed before morning. This class of business can be depended on not to put any overload on the lines and puts into use station capacity that otherwise is not earning more than 50 per cent of the time. Each 1,500-pound commercial machine in service is practically certain to use 400 kilowatt-hours every month, working 25 days. A 1,000-pound wagon of the delivery type running 35 miles per day or 910 miles per month will use nearly 300 kilowatt-hours per month. The flat-iron customer is eagerly sought, yet this user consumes in the neighborhood of only 10 kilowatt-hours per month, even if the iron is used for the household laundry work. On the other hand, every truck installation would consume an actual amount of power equal to thirty-five or forty times that amount. A ton-and-a-half truck in regular service would equal approximately 35 electric fans in service 28 days per month, eight hours per day. The accompanying table, compiled by a vehicle manufacturer, shows the equivalent of a vehicle load in flat-irons, fifty-watt lamps and arc lamps:

ELECTRIC VEHICLES. Type of Vehicle.	Estimated K. W. Hours average annual demand.	Number of 550 watt arc lamps, 4 hours daily, 300 days.	Number of 50 watt incandescent lamps, 2 hours daily, 300 days.	Number of 250 watt 3-16 flat irons, 1 hour daily.
5-ton truck	8,300	13	276	111
3½-ton truck	7,200	11	240	96
2-ton truck	5,500	8	184	74
2,000-lb. wagon	3,800	6	127	51
1,000-lb. wagon	3,100	5	103	41
750-lb. wagon	2,300	3	77	31

Equivalent of Electric Vehicle Load in Flat Irons, 50-Watt Lamps and Arc Lamps, as Estimated by General Vehicle Company.

The residence lighting load, which is energetically sought after by every company forms the greater portion of the business in a majority, perhaps, of the smaller cities, yet to accommodate increases in this load expensive line extensions must be made, and still more expensive machinery bought. When it is considered that one electric vehicle consumes as much power as 25 average residences and does this without requiring one cent invested in station machinery, and only a small amount in lines, it is apparent that the central station can make a considerable concession in rates to secure this off-peak business. Some of the larger stations are offering not only low rates, but free service to the vehicle users, regular inspection of batteries, advice as to proper operation, proper care for the particular service, etc.

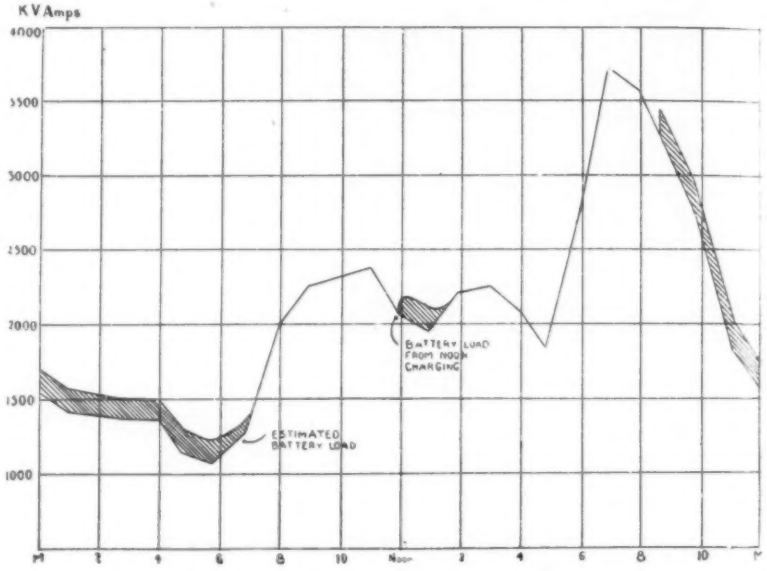


Fig. 1.—Typical Load Curve in City of 40,000.

This kind of service is everywhere possible, for the electric vehicle manufacturers stand ready at all times to give central-station managers, whether they are agents or not, the benefit of their special knowledge and experience. The direct solicitation of a manufacturer, dealer or trucking concern can be aided to a considerable extent by asking some reliable vehicle manufacturer to work on the prospect in cooperation with the central station. In order to do this successfully a certain amount of definite working data should be obtained and placed at the service of the manufacturer. The number of horses that the prospective customer uses, his average mileage per wagon per day, the weight and character of the loads carried and the average number of stops the wagons make per day should all be taken into consideration. In obtaining, thus, the assistance of the manufacturer it is also well to state something of the character of the streets over which the vehicles must operate. If the manufacturer is also supplied with the rates at which power for such service is sold, he will be able to give the prospective customer a very close estimate on what his wagons will cost to operate, when properly cared for. To see that they are cared for is the work of the central station, and here again the manufacturer is always ready to give his advice and suggestions.

The small businesses using but two or three wagons and carrying comparatively light loads can make as good use of electrics as can large manufacturers using many vehicles and carrying at the same time heavy weights. The grocer, the butcher, the confectioner, the florist and the baker are all good prospects. There is in fact no prosperous business that will not bring a return to the central station that more than pays for the difficulty of placing electric vehicles in service.

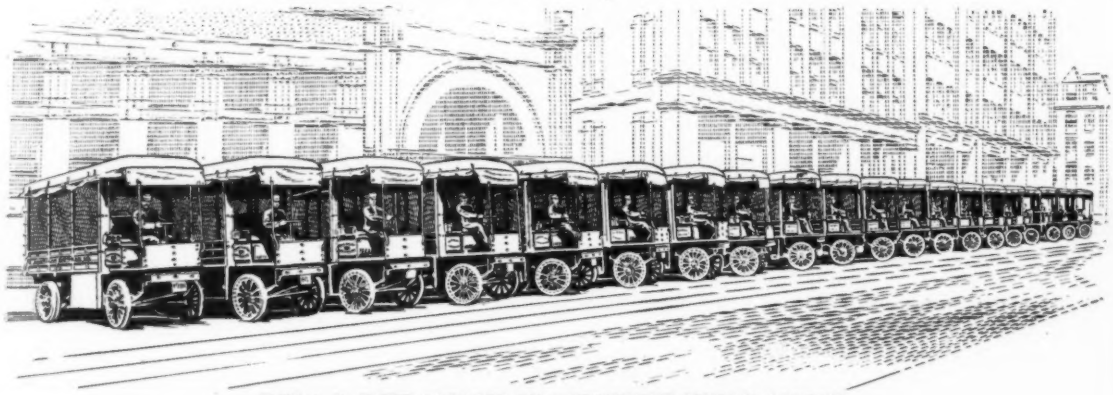
If a part of the energy spent each summer in boosting fans and flat-irons, and each winter in selling cooking utensils were devoted to familiarizing the proper prospects with the merits of the electric vehicle, the reward would be large.

One idea of what can be accomplished may be gained from the load curve (Fig. 1), which is here reproduced. This curve shows the actual load conditions of a city of 40,000 on a day in September. The shaded portion included indicates what might be expected if fifty 1,500-pound vehicles of the delivery type could be added. These

G. V. Electric Trucks Grow in Public Favor

Over 100 G. V. Trucks were sold during January, and 1913 looms big for G. V. orders. Among the new customers are a Kansas City bakery, a brass foundry in Boston, a lock plant in Connecticut, a textile mill in North Adams, a storage warehouse in Brooklyn, N. Y., several brewers, department stores in Washington and Springfield, Mass., and a flour mill in Vancouver, B. C.

Reorders came in from American Express Co. (25 more 2-ton trucks for Boston, making 104 G. V. Trucks for this one company), Eastman Kodak Co., National Cash Register Co., Thompson's Restaurant, Chicago, and many others.



THIS G. V. FLEET GARAGED BY A PROMINENT CENTRAL STATION.

In February the sales were almost as great and the distribution quite as varied. Central Stations were well represented, and several placed initial orders.

Central Station Managers who would like to know just how others are doing it should write us for "The Central Station Public Garage," an unusual story by a disinterested editor of note. It tells just how a Central Station solved the problem of handling Electric trucks and influenced the placing of about 70 in its city in less than two years. Gives details of garage management, method of billing customers, rates for current and all that any wide awake commercial manager needs to lay the right foundation for future profits on off-peak business. Write for it today.

Catalogue 85 on request. Also comparative cost figures on horse, Electric and gasoline vehicles

General Vehicle Company, Inc.

General Office and Factory:

Long Island City, N. Y.

New York **Chicago** **Boston** **Philadelphia**

would take in the neighborhood of 3.5 kilowatts each, and the slight difference in the load curve, as indicated would mean an increase in income of approximately $600 per month, with power at three cents per kilowatt-hour.

The curve of the Commonwealth Edison load (Fig. 2) shows in the same way what the difference would be if half of the horses in Chicago were replaced by electric vehicles.

The arguments which can be used by a solicitor in securing vehicle charging business—that is, creating electric vehicle users—are so many and varied that it seems as if any user of horses could see among them at least one advantage great enough to make the use of electric vehicles really an object to him. Yet too much stress cannot be laid on sticking closely to facts, for a user who thinks his mileage is less than was represented, or his charging bill too high, is worse than no user at all. The man who would recommend electric vehicles in delivery service which must necessarily include long stops, tying the investment up for a considerable portion of the time, or involve long country trips, is doing more to hurt the situation than to help it.

One of the things that appeals to a great many firms of bakers, butchers, florists and the like, is the advertising value of the vehicle itself. Their special attention should be called to this opportunity of announcing to the public that their goods are delivered in "clean, silent, electric vehicles."

The most forcible selling argument in favor of electrics as against horses is the fact that the costs are for the right service are actually much lower per mile than can be possible with the best managed horse and wagon equipment. On one of the installations of the Denver Gas & Electric Light Company the delivery cost in one large store was brought down from 4.5 cents per package to three cents, which amounted at the end of the month to a considerable saving.

Too much stress cannot be laid on the fact that while the cost of electricity has actually greatly decreased during the past ten years, the price of practically every other commodity, gasoline included, has risen. An analysis of conditions on the system of the Commonwealth Edison Company, Chicago, based on three hour's daily use of a maximum demand of 5 kilowatts, and 10 hours' use of a maximum of 50 kilowatts, shows a decrease of 40 per cent for private garages and 70 per cent for public garages. The decrease has been brought about by greatly increasing the diversity factor through the securing of off-peak business of various sorts, with a consequent improvement of the load-factor and a more economical use of machinery and lines.

The fact that there is no fire risk connected with the electric vehicle may be the deciding point in bringing about a sale, and in many cases it is practically necessary for delivery wagons to go into warehouses that are not fire-proof. This point is one that cannot only be emphasized in getting business through solicitors, but also brought out in advertising copy.

The advisability of giving advice and unlimited assistance to people wishing to go into the electric garage business cannot be questioned, and it is as much the duty of the central station to see that these garage owners are properly instructed as it is that of the electric vehicle manufacturers or the makers of apparatus. It is with the central station, in fact, that the whole key to the situation rests. Manufacturers' agents can only make flying trips to smaller cities, while the central station is in a position, if it but takes advantage of it, to give advice and assistance at all times with a practical certainty of good results.

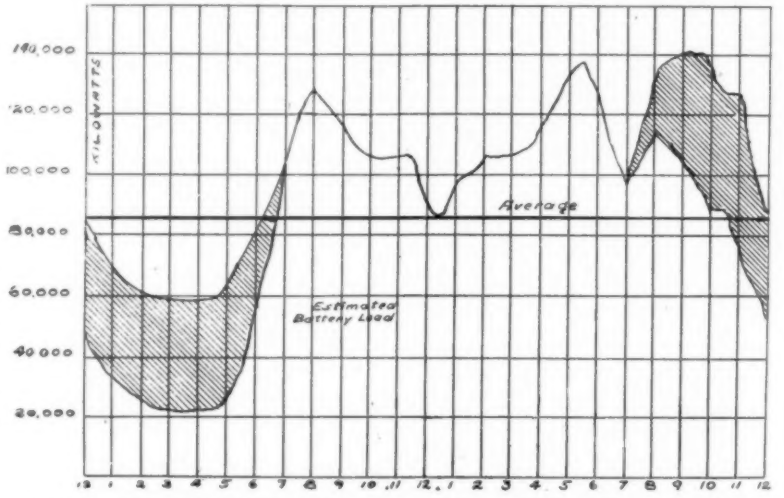


Fig. 2.—Commonwealth Edison Load Curve. Shaded Portion Shows Load of 36,000 Kw. from 8 P. M. to 6 A. M. Estimate Battery Charging.

It cannot be denied that a great deal can be done and is being done by advertising that contains real selling arguments whether this is placed in daily newspapers or presented in the form of booklets. The illustrated lecture gives an opportunity of really informing the public, and showing them by stereopticon slides what is being done by other companies.

The Denver Gas & Electric Light Company uses newspaper advertising and also publishes a magazine known as *The Electric Vehicle*. The Commonwealth Edison Company uses the *Electric City Magazine* to extremely good advantage, and has devoted several special numbers to the exploitation of the electric vehicle. The campaign in the former city resulted in a vehicle load which now amounts to 2,160,000 kilowatt-hours per year, and brings in an annual income of $64,800.

Some of the newspaper advertisements of the Commonwealth Edison Company are shown herewith, and it is believed that this advertising copy has had a great deal to do with bringing the vehicle load in Chicago up to its present point. The illustrations are always pertinent and attractive, and add a human interest that very often impels a reading of the type matter.

The matter of just what concession in the way of rates may be made in order to secure electric vehicle business must be decided independently for each case, although a great deal may be learned from precedent established by other companies. It should be borne in mind, however, that as neither extra machinery or a very great amount of line work is necessary, a very low rate may be fixed. The customer earns this by his willingness and ability to use the machinery and service of the station when otherwise it would be idle.

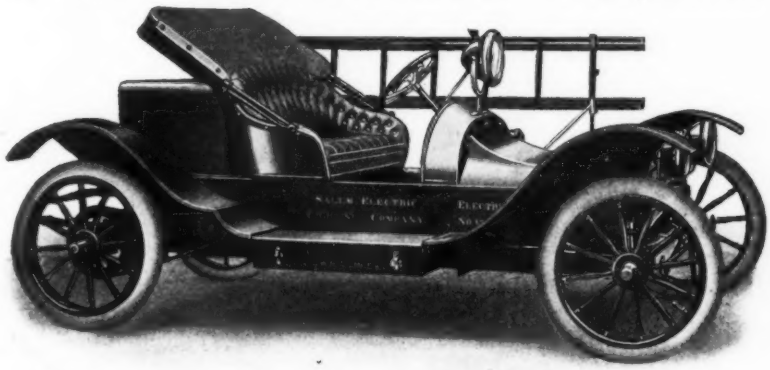
One of the most active of the pioneers in the campaign for electric vehicles, the Denver Gas & Electric Light Company, has made a rate of three cents per kilowatt-hour, less 50 per cent, less 10 per cent. This rate, however, entails a readiness to serve charge of $90, and is only applicable to public garages. For private garages the rate made includes a charge of $5 per month, and four cents per killowatt-hour for power used. The Hartford Lighting Company of Hartford, Connecticut, offers an entirely off-peak rate with a minimum monthly charge of $20. This rate provides for a discount of 40 per cent on all power used off the peak, and meters are furnished free in cases

Bailey Electric Roadster

Edison Battery

Especially Designed for

Electric Light and Power Companies



Roadster Adapted for Street Arc Lamp Trimming and Patrol Service

The large box back of the seat serves to carry arc lamp globes, carbons, etc., and on the inside is 32 inches long, 23¼ inches wide and 16⅞ inches high. Felt lined compartments to suit.

Each running board box measures inside 35 inches long, 12 inches wide and 5¼ inches high.

The car can be equipped as shown with irons for carrying extension ladder and with search-light on swivel bracket on dashboard.

The battery capacity, the speed and mileage can be varied to suit requirements

BOSTON EDISON CO.'S TEST OF FAST ROADSTER, JUNE 11, 1912
ONE CHARGE OF BATTERY

103.2 miles in 5 hours, 7½ minutes
Average speed 20.14 miles per hour

Route.—Boston to Pawtucket, R. I., and return (78 miles), remainder of run about Boston

OTHER RECENT RUNS
SHOWING HIGH AVERAGE SPEED OBTAINABLE

Nov. 20, '12, Springfield, Mass., to Hartford, Conn., 28.4 miles, in 1 hour 21 minutes.
Average speed, 21.0 miles per hour.
Hartford, Conn., to Springfield, Mass., 26.9 miles, in 1 hour 17 minutes.
Average speed 21.0 miles per hour.
Nov. 21, '12, Springfield, Mass., to Worcester, Mass., 52.9 miles in 2 hours 36 minutes.
Average speed, 20.3 miles per hour.
Worcester, Mass., to Boston, 42.6 miles, in 2 hours 1 minute.
Average speed, 21.1 miles per hour.
Dec. 11, '12, Boston to Lowell, Mass., 25.9 miles, in 72 minutes.
Average speed 21.6 miles per hour.

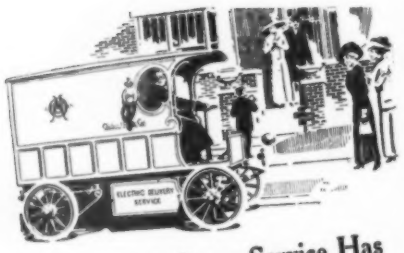
The first Bailey Roadster was brought out in the winter of 1911-1912, and the following are electric light companies which have placed orders up to date:—

Edison Electric Illuminating Co., of Boston (18)
Malden Electric Co., Malden, Mass. (3)
Commonwealth Edison Co., Chicago. (2)
Haverhill Electric Co., Haverhill, Mass.
Franklin Electric Light Co., Turners Falls, Mass.
Minneapolis General Electric Co., Minneapolis, Minn.
Omaha Electric Light & Power Co., Omaha, Neb.
Stamford Gas & Electric Co., Stamford, Conn.
Salem Electric Lighting Co., Salem, Mass.
Montreal Light, Heat & Power Co., Montreal.
Concord Municipal Light Plant, Concord, Mass.
Lynn Gas & Electric Light Co., Lynn, Mass.
Cambridge Electric Light Co., Cambridge, Mass.
New Bedford Gas & Edison Light Co., New Bedford, Mass.
Harrisburg Light & Power Co., Harrisburg, Pa.
Blackstone Valley Gas & Electric Co., Pawtucket, R. I.
Edison Electric Illuminating Co., of Brockton, Mass.
Commonwealth Water & Light Co., Summit, N. J.
Consumers Electric Light & Power Co., New Orleans, La.
Suburban Gas & Electric Co., Revere, Mass.
Cosmopolitan Electric Co., Chicago, Ill.

The Bailey Car has a remarkable suspension, simplest possible control, low center of gravity, extreme accessibility of parts and a simple and durable construction.

S. R. Bailey & Co., Inc., 895 Boylston St., Boston

Factory at Amesbury, Mass.



Electric Delivery Service Has Immense Advertising Value

Mr. Merchant, do you realize that the public good-will is remarkably influenced in favor of any concern using Electric Delivery Service? The trim, neat, efficient appearance of an Electric Delivery Wagon impresses every passer-by—makes people think unconsciously of the up-to-dateness of the establishment it serves.

Why not get *your* legitimate share of this valuable advertising? Why not let Electric Delivery Wagons help to make present and prospective customers think favorably of *your* store? Every merchant, large or small, really ought to investigate the many advantages of Electric Delivery Service.

Electric Delivery Wagons Are Cheapest and Most Efficient

Electric Wagons are 20% to 50% cheaper to operate than vehicl of any other type. Their use makes fewer wagons necessary—cu down expensive details of operation that make your present co of doing business so high. On the hottest days or the coldest— rain, sleet or snow—you can depend on an Electric to do its wo efficiently—without loss of time. Any man now in your emp can learn to drive an Electric—no need to hire expensive new r who do not know your routes. An Electric has a longer li needs fewer repairs than any other vehicle.

Our Vehicle Expert is freely at the service of interested business men. 'Phone Randolph 1280 for appointment.

Commonwealth Edison Compa
120 West Adams Street

An Electric— The Car Desirable

Simplicity is the keynote of an Electric. Its ease of operation makes needless the services of a chauffeur; its cleanliness and quiet running qualities make it the ideal pleasure vehicle.

The owner of an Electric is entirely independent of weather conditions. In sun or shower, driving rain or snowstorm, an Electric offers luxurious protection and perfect comfort.

Enjoyment and Convenience For the Entire Family

You, your wife, your child—anyone may run an Electric anywhere with perfect safety. Cranking is unnecessary. Its mechanical perfection assures reliable service and reduces the ordinary inconveniences of the motorist to a minimum.

For $30 a month a garage will, in addition to the usual garage service, keep the storage batteries charged. If one installs a private battery-charging outfit in his own garage, the cost is reduced to about $10 a month.

Commonwealth Edison Compa
120 West Adams Street

Which Would Be Better For Your Business?

Which would you rather have, Mr. Vehicle-User—your present inefficient, expensive transportation service, or dependable, economical Electric Commercial Vehicles? Do you realize that every extra penny your present delivery system costs you is a penny taken from your legitimate profits? Are you willing to continue in this way, when you can have high-grade, inexpensive delivery service so easily, by using Electric Commercial Vehicles? Whether you need a fleet of 5-ton trucks or only a light delivery wagon, the Electric will serve you best and cheapest. And it brings you much valuable advertising from a satisfied public.

The Electric Commercial Vehicle

Any inexperienced man now in your employ can quickly learn to operate an Electric. There are no mechanical difficulties, no freezing or overheating. An Electric does not eat up power or feed when not in operation. And the present operating cost is far less than the cost of operating other types of vehicles.

Commonwealth Edison Company
120 West Adams Street

¶ The exhibits of Electric Commercial Vehicles at the Automobile Show are further and final proof of the superiority of the Electric for city transportation service. A visit to these exhibits may result in reducing your haulage cost from 10% to 25%. Be sure to see them.

Our Electric Vehicle Expert will gladly confer with you. Just 'phone Randolph 1280.

Commonwealth Edison Company
120 West Adams Street

¶ The Electric has proved its case. If you want the acme of comfort and convenience at minimum expense, you should own a safe, simple Electric.

¶ The exhibits of Electric Vehicles at the Automobile Show are achievements of mechanical perfection and beauty of design. Be sure to visit them.

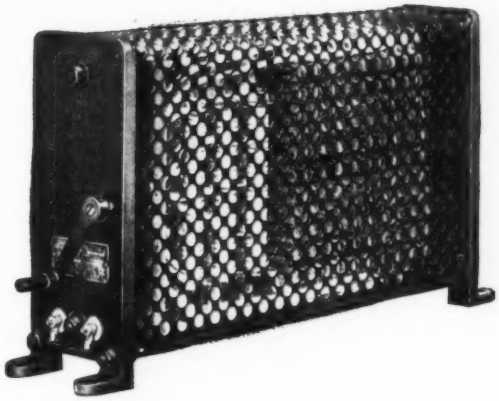
The services of our Electric Vehicle expert are gladly extended to those interested. Just call Randolph 1280.

Commonwealth Edison Company
120 West Adams Street

Battery Charging Equipment

Perfection in Every Detail

The Improved CR-211 Rheostat



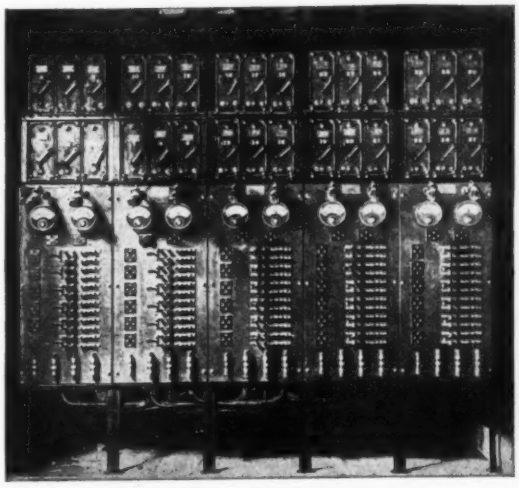
For Vehicle Battery Charging

Here Are the Features Which Combine Convenience with Safety and Allow Maximum Returns from Your Equipment

The perforated metal cover protects the parts from injury, eliminates the possibility of accidental contact and yet provides ample ventilation.

This cover is easily removed, allowing complete inspection and access to all parts.

Connections to terminals may be made on the inside or outside of the case as desired.



Switchboard of Public Garage Equipped with CR-211 Rheostat

Large numbers of contact insures maximum regulation of current.

Can be placed on the floor, wall or switchboard of the garage.

The large number of sizes standardized by this company enables you to select the best rheostat for your batteries at minimum cost.

Standard Lines for Both Lead and Edison Type Cells

in all capacities, from the smallest ignition cells to the largest vehicle batteries. Explained and illustrated in the New Bulletin No. 4934. Furnished on request.

Ask about the new CR-211 Rheostat for charging Edison cells at normal or double normal rate.

General Electric Company

Largest Electrical Manufacturer in the World. 3472

List of Sales Offices on Second Page Before Editorial Section.

The Guarantee of Excellence — on Goods Electrical.

where this off-peak consumption exceeds 10 per cent of the total. These companies and others have found the business secured more than warranted the concession.

Electric vehicles will, without a doubt, take a place well toward the front as consumers of central-station energy, but the magnitude of the whole industry, and the time necessary to secure proper recognition depends on the individual efforts of every central station as well as each manufacturer. Until each one brings all his efforts to bear, the greatest good cannot be realized; and each one is not doing his share as long as the vehicle users remain blind to the great benefits that can be secured by a proper use of the right vehicle and the best method of maintaining it.

Electric Truck Performances.

Facts and Figures Showing Why the Electric Is Gaining Steadily in Prestige and Popularity.

By J. A. McMeel.

There is so much in favor and so little against the adoption of electric delivery service that it is a hard matter to understand why a greater progress has not been made in the larger cities of the country. It is a known fact that electrically propelled machines can economically handle a large portion of the trucking in our cities, but why they are not doing more than at the present time; why firms have not taken to the electric and used it more extensively as a trackless transportation medium; why the electric has not succeeded in more successfully prying the horse out of his position as a beast of burden, which he so completely holds at the present time, and why it has not even kept abreast of other forms of motor equipment are questions which to most of us are unanswerable.

On all sides we see the electric performing in a way that should make any business man "sit up and take notice." We learn from various sources that electric trucks in the service of different companies, both in the East and West, are not only effecting economy in trucking, but are bringing about that all important essential on a large scale. In the main we know that trucks are the proper hauling equipment, the economical form of haulage, as well as we know they are reliable and powerful when compared with the form of transportation in vogue at the present time. The situation, therefore, resolves itself into this question: Are electric trucks being pushed; are the firms which will eventually derive the revenue from their extensive use taking the initiative, pushing their sale in the vigorous manner in which it should be pushed? Central stations which are now or have for some time been actively engaged in the sale of electric commercial machines and pleasure cars know the answer. They know that in their particular case electric vehicles are receiving just as much attention as is the sale of electric irons or any of the other off-peak building appliances, but the companies which have deemed it advisable to let the electric truck work out its own salvation—as it will in course of time—or who probably have not even considered the sale of electrics of enough importance to be taken under advisement, also know the answer to this question. They know, respecting their own conditions, of course, that electric trucks and even pleasure vehicles, in their own community, at least, have not been given the support or the stimulus to bring about a greater use of them. Let us ask—why haven't they?

From various sections of the country bits of information concerning the truck situation come to hand and shed light on one side or another of the question. An important announcement was recently made in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN concerning the withdrawal of the Union Electric Light & Power Company from the field of selling trucks, but the same information stated that the company had not quit altogether. It had simply retired from active selling as the electric had become so well known that it deemed it inadvisable to continue in a competitive capacity.

Through this announcement we learn that in 1906 there were but 11 electrics in use in St. Louis, but upon the withdrawal of the St. Louis central station from the selling field a total of 700 machines were in daily use on the streets of the Missouri city. In the six years this company was engaged in the selling of electric trucks and pleasure vehicles it succeeded in disposing of nearly one hundred machines every year, on the average. Has this company been repaid for its efforts?

No matter from what angle you look at the electric vehicle you will always see the signs which indicate that the electric truck has come to stay. We have in mind the case of a Lansden machine, equipped with an Edison battery, which came within 1,061 miles of traveling around the globe, the circumference of which is 24,902 miles. This truck was fitted with an Edison battery on December 4, 1908; a test of the cells at that time showing 180 ampere-hours capacity. Four months later another test was made showing the capacity had increased to 203 ampere-hours and on December 13, 1911, a few days over three years from the time the battery was first installed, a third test was made revealing the fact that the capacity was then 205 ampere-hours. This machine was in actual daily service and on December 13, 1911, the odometer showed 20,932 miles to have been traveled in 916 days of actual running time—an average of 23 miles per day. Up to March 12, 1912, a little more than three months after the last test was made on the batteries, the truck traveled 1,909 miles, making the total distance covered 23,841 miles. That is an illustration of the durability and life of the present day battery, and here is another:

W. C. Moore, a Buffalo, N. Y., newspaper man, purchased a Waverley electric pleasure car equipped with Gould batteries. This vehicle had been in constant use, running a total of 4,867 miles. This man did his own charging and the cost for the entire year was $82.90, demonstrating that electrics are of about equal value to the owner and the central station. Outside of expense for charging no other was entailed.

From Cheyenne, Wyoming, we learn that a Baker coupe, in which an Exide battery is installed, and which is owned by Wm. R. Schnitger, president of the Wyoming Life Insurance Company, accomplished on Cheyenne streets, which are not paved and which rain and snow place in such condition that it is more or less of a strain on electrics, from 50 to 80 miles, indicating that no matter what the service the storage battery of the electric vehicle is equal to the occasion. Additional data relative to the same service could be supplied in quantities, but as space will not allow its publication, we cite these instances simply to show that the electric machine can be depended upon under almost any conditions.

A Large and a *Permanent* Income for Central Stations

The use of electric vehicles is growing at an enormous rate. Especially is this true of electric commercial vehicles. "Electrics" have been proven to be the most efficient, reliable and economical conveyance for either light delivery or for heavy haulage, as well as for pleasure purposes, in cities and suburbs. The subject of "Electrics" demands the attention of every Central Station.

Central Stations are well aware of the large income to be obtained from the charging of electric vehicle batteries.

Central Stations also realize that this is a specially profitable revenue, since the charging of batteries is usually an off-peak load.

But there is something else which Central Stations should consider besides selling current—and it is most important.

Central Stations should help to increase the use of "Electrics" and see that vehicle users get good service from their cars. Satisfied owners are the strongest advertisers of "Electrics."

Reliable service makes satisfied users and such service depends largely upon the battery.

Vehicle battery charging becomes a steadily increasing and permanent revenue to Central Stations who endorse

The 4 "Exide" Batteries

"Exide", "Hycap-Exide", "Thin-Exide", "Ironclad-Exide"

This is not a sweeping assertion. It is a fact—being proved every day.

Here is the reason. The four "Exide" Batteries, each having its special field of usefulness, are the results of years of experience by the best battery engineers in the country. They are practical, troubleproof and reliable batteries which can be placed in electric cars and day after day, with minimum attention and under all conditions of road or weather, they will give long life and dependable, economical service.

This is the sort of service you want vehicle users to secure. This kind of service will increase the use of "Electrics," will increase your revenue and will make it a permanent source of income.

And last, but not least, your endorsement of "Exide" Batteries will be backed up by the reputation of the oldest and largest battery maker in the country. You will also have at your disposal expert battery help or information, furnished by an "Exide" service organization which extends throughout the country, with headquarters in all leading cities.

Boost "Electrics" and "Exide"

THE ELECTRIC STORAGE BATTERY CO.

MANUFACTURER OF

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

New York Boston Chicago St. Louis Cleveland Atlanta Detroit

PHILADELPHIA, PA.

1888-1913

Denver San Francisco Seattle Los Angeles Portland, Ore. Toronto

The question has often been asked why the American Express Company is so partial to electric trucks for delivery and pick-up work. As in the case of every other concern, it is service; an example of which will be found in the following information, given out by C. L. Chase, manager of the Denver Branch of this company. During Christmas time this company did a big business and its two Baker electrics, which were placed in service a short while before the holiday season, helped materially in taking care of the rush of business. According to Mr. Chase these trucks did the work of seven horses and five wagons, traveled 50 miles each day and worked from 7:30 in the morning to 8:30 at night without a let-up, except at noon when the driver was given time for lunch. If the American Express Company receives the same service from the 300 other electric trucks it has working, there is little room to wonder at the enormous investment which this company has made in commercial machines of this type.

Out in Los Angeles, the City Dye Works until a short while ago employed delivery equipment which cost $1,678 a month to keep up. It consisted of 28 trucks. Not being satisfied the management of this concern requested the Waverley company representative in that district to demonstrate the electric. The week, picked out beforehand, during which the electric trucks was to be tested, proved to be a bad one, as it rained continually, but despite conditions the Waverly electric did such good work that at the end of the week the company placed an order for 30 machines of the Waverley manufacture, and the cost per month for maintaining this equipment amounts to $240. An incident which demonstrates the ability of the electric as a hill climber was brought to light during the week this test was conducted. A hill known as the "Back-Side" of Second Street, having a grade between 25 and 40 per cent was negotiated with such ease that it finally convinced the dye company management that electrics were satisfactory and the deal for the purchase of the 30 electric wagons was closed. Here is something else that an electric did satisfactorily:

An electric truck of six tons' carrying capacity successfully hauled a steel girder weighing 35 tons and two other motor trucks, making a total load of 40 tons, across a bridge in Rochester, N. Y., when 14 horses were unable to budge the load. Further evidence of the quality of electric truck service is found in the following:

In Tarrytown, N. Y., the Rockdale Ice Company uses a five-ton machine for freighting ice between its manufacturing plant and the distributing depot. This truck has displaced 4.7 teams on hauls from four, 12 and 17 miles in length, and it was found that the total cost of operating the truck for one day amounted to $12.97 as against $21.15 for the teams and wagons, figured on the basis of $4.50 for each horse outfit. The truck covers a distance of 42 miles while the horse-drawn vehicles were able to travel 20 miles. In this instance, although double the mileage is accomplished, a saving of $8.18 per day, or for 300 days, $2,454, has been effected since the adoption of motor truck service.

There are many departments of the municipal service of our cities in which the electric truck has rapidly fitted itself, such as hauling garbage, street sprinkling, inspection service, patrol and ambulance service and fire duty. In this connection we find that the city of Springfield, Mass., has accepted electrically propelled equipment to the exclusion of all other kind of motor service. A ladder truck carrying 325 feet of ladders and a crew of seven men, has four three-horsepower motors and 80 cells of a 17-plate battery. The truck weighs complete 10 tons and on a single charge at full speed it makes 15 miles, the guaranteed maximum speed on a level roadway being 20 miles per hour.

A chemical wagon in the fire service of the same city carries a 40-gallon chemical tank, 200 feet of chemical hose and 1,000 feet of regular hose. This machine is equipped with four three-horsepower motors and it weighs seven tons. Its guaranteed speed is 30 miles per hour and the battery equipment is the same as in the ladder truck. This truck, on a 12-per-cent grade, has made a speed of 12 miles per hour and on a test run the ladder equipment climbed the same grade at the rate of eight miles per hour. In this particular case the margin of saving in favor of the electric equipment, as compared with the cost of the displaced horse equipment, amounts to nearly 100 per cent. The cost of energy during the first month's service was $3.78 and for the second it increased to $7.77, probably due to an increase in the number of calls. The rate charged by the central station for current is three cents per kilowatt-hour.

Although the investment in electrical equipment, which cost $12,000, is considerably more than a first-class horse outfit, costing $5,500, the difference in cost is justifiable, because of the greater expense entailed in maintaining the horses, which amounts to $1,000 a year, assuming that the horses are given the best of attention, and fire horses demand first-class care at all times.

It is a pretty widely known fact that the brewing industry has made a large expenditure for electric commercial vehicles and the success with which these interests have been operating this type of machine can be taken as an indication of what may be expected from motor vehicles in other lines of business. One of the strongest boosts the electric ever received came, unsolicited, from Jean A. Blaise, superintendent of the transportation department of the Doelger Brewing Company, of New York City, at the recent convention of the Electric Vehicle Association of America. Among other things Mr. Blaise stated that 58 electric trucks were saving $80,000 a year for his company. Two men, one at $23 and one at $14 per week are required to look after the electrics. This company has disposed of its entire stable of 200 horses and in so doing twenty-eight city lots, valued at $20,000 each, or a total of $560,000, have been released, as the horse stable which was 350 x 350 has been replaced with an electric garage 85 x 100 feet, and the ground formerly occupied by the horse stable will be utilized for buildings in which beer will be bottled. The delivery of beer formerly cost this firm 35 cents per barrel, but with the electrics this has been reduced so that within the eight-mile radius the cost of delivering amounts to 15 cents per barrel. It is expected that as soon as additional trucks are installed—eight of which have been ordered—there will be a further reduction made. It is also presumed that beer will be delivered with the aid of more trucks at a cost of 12½ cents per barrel and this company expects to pay for its complete change to electrics in three years with the saving effected. After that time it can be seen that the saving will become more in the form of an earning.

Another instance of where real economy has been effected by the use of electric trucks by the brewing trade is found in the experience of the Jacob Ruppert Company, also of New York, which has 83, purchased at intervals covering about seven years. A saving of $833.33 per machine per year is now being realized by this company. Out of 120 powerful horses, valued at $1,500 and $2,000 per team, only 50 remain in service, and in the meantime business has increased constantly. The cost of delivering beer, when the company was using 120 horses was 33.7 cents per barrel. With electrics it has been 24.75 cents per barrel, a reduction of approximately nine cents on each one. Although the horse equipment hauled about the same load as the electric—11,000 pounds—the distance traveled by each kind of equipment shows a wide variation. Horses accomplish only 12

Books on Electric Vehicles

The Automobile Hand-Book

By L. ELLIOTT BROOKES, Assisted by Other Well-Known Experts

Revised and Enlarged 1911 Edition. 16mo, over 650 Pages and over 320 Illustrations. Full Leather Limp, Round Corners, Red Edges. Price $2.00.

The automobile hand book is a work of practical information for the use of owners, operators and automobile mechanics, giving full and concise information on all questions relating to the construction, care and operation of gasoline and electric automobiles, including road troubles, motor troubles, carbureter troubles, ignition troubles, battery troubles, clutch troubles, starting troubles. With numerous tables, useful rules and formulas, wiring diagrams and over 320 illustrations.

Power transmission is thoroughly discussed, and the various systems of transmitting the power from the motor to the driving axle are analyzed and compared.

The perusal of this work for a few minutes when troubles occur, will often not only save time, money, and worry, but give greater confidence in the car, with regard to its going qualities on the road, when properly and intelligently cared for.

This is a brand new book from cover to cover—1911 Edition—and must not be confounded with any former editions of this popular work.

TEXTBOOK ON MOTOR CAR ENGINEERING. By A. G. CLARK

To be complete in two volumes. Vol. I., Construction. 213 illustrations. 6x8¾. Cloth. 457 pp. Price $3.00.

Contents: General Principles and Construction of the Petrol Engine; Details of Engine Construction; Petrol and Other Fuels; Carbureters and Carburation; Thermodynamics of the Petrol Engine; Horse Power; Mechanical, Thermal and Combustion Efficiencies; Principles and Construction of Coil and Accumulator Ignition; Magneto Ignition; Engine Control and Cooling Systems; Crank Effort Diagrams; Clutches and Brakes; Gears, Lubricants, Lubrication Ball and Roller Bearings; Chassis Construction; General Principles of the Steam Car; Steam Engines and Condensers; Steam Generators and Pipe Diagrams; The Electric Car; Materials Used in Motor Car Construction; Examination Papers; Physical Properties of Petrol; Mathematical Tables and Constants.

PRACTICAL AUTOMOBILE DICTIONARY. By S. KRAUSZ

English-French-German; French-English-German; German-French-English. With an introduction by C. J. Glidden. Twelve thousand technical terms and other words employed in connection with motor cars and motoring. For use in office, factory, repair shop and touring in foreign countries. 16mo. Leather. 129 pp. Price $2.00.

SELF-PROPELLED VEHICLES. By JAMES E. HOMANS

A practical treatise on the theory, construction, operation, care, and management of all forms of automobiles. Seventh Edition, revised. 500 illustrations. 6x9. Cloth. 667 pp. Price $2.00.

The various theories and problems involved in the construction and operation of the prevailing types of motor road carriages have been stated as clearly as possible, in order that the involved situations may be readily comprehended by all readers. The fundamental principles of the several types of motor, particularly of the gasoline engine, which is the least understood of all, have been treated at considerable length, in order that the facts may be thoroughly comprehended in their new relations.

THE AUTOMOBILE. By P. N. HASLUCK

A practical treatise on the construction of modern motor-cars, steam, petrol, electric and petrol-electric. Three volumes. Special Edition, enlarged. 1,200 illustrations. 8vo. Cloth. 1,300 pp. Price $10.00.

A very handsome set of instructive books brought up to date in the third volume containing many elaborate illustrations of cars now in use.

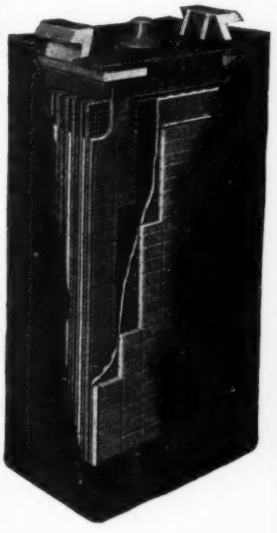
Electrical Review Publishing Co.

Western Headquarters for Electrical Books

608 S. Dearborn St.

CHICAGO

One GOULD Storage Battery Tried Means More Because Users Want More of the Same Satisfactory Service.



Trying out a lot of storage batteries on the "Survival of the fittest" plan is expensive, troublesome, and if you try Gould Batteries first, will be found unnecessary.

Tests thoroughly prove that Gould Storage Batteries combine high capacity and long life to an extent not found elsewhere, and as we base the selection of a battery in each instance upon the purchaser's service conditions, the customer takes no risk.

Making Gould Batteries give good service is just as important to us as making sales. Hence our engineering representatives and inspectors, scattered throughout the country, will gladly advise on any points in connection with the operation of Gould Batteries. If you want to know how and how much your present battery can be improved, if you anticipate requiring renewals soon (Gould Battery renewals fit any battery jars), if you are investigating batteries with a view to specifying on a new car, if you want maximum mileage per charge, if you appreciate the absence of battery troubles and cares, or if you want immediate and ultimate battery economy, *write us*. Doing so involves no obligation.

Our statements are conservative and based upon abundant performance records. Any Gould Battery part, which within a fixed period of long duration, does not justify our claims, will be made good upon fair terms. If your storage battery problems are special, our engineers will gladly advise to your best interests as to the best course to follow.

Gould Storage Battery Co.

General Offices: 347 Fifth Ave., New York City

Boston: 89 State Street Chicago: The Rookery

Cleveland: Amer. Trust Bldg. San Francisco: 904 Rialto Bldg.

Works: Depew, New York

Agents

Detroit Topeka Los Angeles Seattle

Montreal Toronto

68

miles a day, as against a rated battery mileage of 35 for a five-ton machine and a speed of seven miles an hour practically twice as fast as the horses were able to go.

As in the case of the Doelger company, the Ruppert interests have trained their horse drivers to operate the electrics, but this is not a new departure from the general practice, as statistics reveal the fact that ex-teamsters are now driving electric machines for various firms in all sections of the country.

Additional facts relative to the service given by electrical equipment could be cited in quantities, but as space will not permit a further discussion of the subject, other facts will have to be taken up at some future date. However, enough reasons to warrant the central station taking an active hand in the distribution of electric machines in their communities have been advanced, and with a combined effort of all interested parties the increase in the sale of trucks of this type should, in 1913, outstrip all previous records.

Expect a Million Autos Soon.

In connection with the automobile shows in New York recently, one of the big dailies presented some interesting figures concerning the probable growth of the automobile industry in the near future.

Almost every state requires automobiles to be registered and the records show almost 1,000,000 cars at the present writing. From this, however, should be deducted the number of cars registered by non-residents, and consideration also should be given to the large number of cars that have changed hands and have been twice registered during 1912. Trade authorities admit, however, that there are now 825,000 cars in actual use in this country, of which 270,000 were made and sold during 1912.

With a very conservative estimate of 360,000 cars for 1913, and with the largest part of that number made in the spring, the first of May should see 1,000,000 motor vehicles in actual use for pleasure and for utility purposes, which, at an average of $900, would give $900,000,000 as the total selling price.

Although statistics are generally uninteresting, those in connection with the motor car industry are most fascinating, for they mark the gigantic strides of an industry that has no parallel in history, easily overreaching as it does the records of any other manufacturing business and marching on toward the figures of oil, coal, lumber, steel and the producers of raw material.

The figures indicate that in another few months there will be a car for every ninety people in the United States. while an authentic list of manufacturers shows 241 companies producing pleasure cars and 280 companies building commercial vehicles, although many of the latter have not turned out more than a few experimental trucks.

With electric self-starters making it easy for women to operate them, the demand for cars is certain to expand, especially at the remarkable values now in the market, as compared with a few years ago, when the average car cost $3,000 or more. Greater values will be offered at the shows than ever before, whether in cars at $500 or $5,000.

In thirteen years, since the first automobile show was held in Madison Square Garden, the industry has progressed at a rate which cannot be appreciated by any one that has not been in contact with the captains of the industry and the great engineers who have shown sublime faith in the ability of the nation to buy and use the vehicle that is now as much of a necessity as it was considered a luxury a decade ago.

Contributory to this wonderful advance must be considered the efficient manufacturing that has made for lower cost and the present moderate priced car; greater simplicity which permits any one to operate and care for a car; the increased reliability and, most important of all, the fact that the motor car, like the telephone, the telegraph and the railroad, is a time saver, and as such is essential to our American life.

Registration figures in the various states show that while New York has the greatest number of cars, California leads in cars per capita. The final report for 1912 of Secretary of State Lazonsky shows the actual number of cars in New York State to be 106,860, of which 9,955 are commercial vehicles.

The State of California has 84,240 cars registered, or one for each 27 people, while New York has only one for each 141 people, because a large proportion of the population in the big cities cannot afford cars.

Maine, Iowa, Nebraska and Delaware have the largest number of cars for their population, while the Southern States, including Virginia, Arkansas, Louisiana, Alabama and Kentucky, have a comparatively small number of cars per capita, the last named state having only one car for each 602 people. In many of these states it is not so much a question of wealth as it is poor roads, which offer little inducement for the use of motor cars.

It will surprise many to learn that there are only 36,112 commercial vehicles registered in the United States, the figures indicating in a slight degree the tremendous future of that branch of the industry.

In total car registration New York State is the leader, with California second and Ohio third, followed by Pennsylvania, New Jersey, Massachusetts, Illinois, Iowa and Michigan, the last named state being considered the home of the automobile manufacturing industry.

When one considers more than 12,500 dealers and garages and the large number of trades that supply motor car factories with material a fair idea can be gained of the magnitude of this new and wonderful industry, so creditable to this nation, that can make and market here and throughout the world (about 27,000 were exported in 1912) cars far in excess of the number that the wildest enthusiast would have dared to suggest a decade ago, when the motor car was declared by many to be a toy of the rich and a luxury that few could enjoy, such statements having been made with never a thought of its blessings and the new position that it secured as the greatest advance in the transportation of the individual man since the days of the Roman chariot.

Electric Vehicle Meeting in New York.

At the meeting of the Electric Vehicle Association of America held in New York City on February 25, an interesting paper by James M. Skinner on the "Philadelphia Thin-Plate Battery" was presented. The paper described the battery, giving data and curves on mileage, speed, weight, efficiency, life, etc. Comparisons with thick-plate batteries were made.

The discussion was taken part in by Matthews Codman, of Boston, Bruce Ford, J. C. Bartlett, Harry Tobias, S. G. Thompson, R. L. Lloyd and others.

E. S. Mansfield, who presided, brought out that the thin-plate battery is the best for all purposes and that the negative plate has the same life as the positive, and is thinner. He favored automatic charging devices when properly operated and stated that it is better to boost a battery than to over discharge it. Also, boosting stations often have insufficient capacity.

A motion was passed asking the Committee on Garages to determine the highest charging rate which should be available at the boosting stations. A vote of sympathy was extended to Frank W. Smith, who is ill.

The Studebaker Corporation's new one-ton truck, which was exhibited at the Chicago Show, is making friends rapidly. The motor is especially made for the Studebaker Corporation by the Wagner Electric Company, and is mounted in unit with the rear axle and located at the point of minimum vibration.